The Impact of Computerized Systems on Efficiency and Productivity of Cooperatives in Rwanda. A Case Study of Cooperative Management System (CMS) Software Developed by MNK Digital Group Ltd

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ABSTRACT

This research analyzed "Project design and implementation of cooperative management system (CMS) software and its impact on the efficiency and productivity of cooperatives in Rwanda" on 146 cooperatives using Cooperative Management System (CMS) across 19 districts of 4 Provinces of Rwanda (Eastern, Western, Northern, and Southern). The study used a sample of 750 respondents including 730 cooperative members from a total population of 61,320 members of 146 cooperatives plus 19 District Cooperatives Officers and 1 Director of Cooperatives Promotion and Capacity Building Unit in Rwanda Cooperative Agency (RCA). A questionnaire designed in form of five levels Likert scale was used and data was collected and analyzed through KoBo Toolbox and SPSS. The results of descriptive statistics showed that overall appreciation of CMS by cooperatives managers is "Good" ($\bar{x}$= 3.8; σ = .270). The regression results revealed that CMS Membership management module was positive and significant to Cooperative productivity and efficiency (β_1= 0.049; p< 0.05); CMS Payments management module was positive and significant to Cooperative productivity and efficiency (β_2= 0.258; p< 0.05); Accounting management module was positive and significant to Cooperative productivity and efficiency (β_3= 0.242; p< 0.05); CMS Human resource management module was positive and significant to Cooperative productivity and efficiency (β4= 0.016; p< 0.05); CMS Requisitioning management module was positive and significant to Cooperative productivity and efficiency (β_5= 0.020; p< 0.05); CMS Credit management module was positive and significant to Cooperative productivity and efficiency (β_6= 0.206; p< 0.05). The coefficient of determination R-squared value for this study is 0.705 (r > 0.7) indicating strong effect size. It shows how that the model fits the data at strong extent. These results indicate that 70.5% of variance in dependent variable was explained by independent variables meaning that 70.5% of change in Cooperative productivity and efficiency come from CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtMod, CMSRequisMgtMod, CMSCreditMgtMod. The main CMS challenges outline by the respondents include CMS is not free and requires additional installation and maintenance fees ($\bar{x}$= 5.0; σ =.000); CMS requires advanced education level ($\bar{x}$= 4.3; σ =.080); CMS has issue of confidentiality of the data managed by the government which hosts the CMS system ($\bar{x}$= 5.0; σ =.000); CMS use requires additional cost for internet ($\bar{x}$= 4.1; σ =.351). Proposed solutions are: Support from the RCA on installation cost and the cooperatives should cover maintenance costs($\bar{x}$= 4.8; σ =.070); More training on even members with good primary education on the use of CMS ($\bar{x}$= 4.3; σ =.380); Confederations should play important role in the management of CMS and the role of the government should be reduced ($\bar{x}$= 4.9; σ =.290); The government should reduce the cost of internet

($\bar{x}$= 4.7; σ =.151); More capacity building for cooperative managers.

Keywords: Cooperative Management System, Computerized Systems, efficiency, productivity, cooperative.

BACKGROUND TO THE STUDY

Globally, (International Cooperative Alliance, 2014) defines a cooperative as an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. The members of cooperatives can be natural persons or corporate bodies. They are an alternative to the capitalist approach of most businesses: a type of economic-social cooperation. As a result, the cooperative, which aims to apply the social well-being of the work world to a business level, is a non-profit-making service enterprise whose objective is to free its members from any exploitation they are suffering by strengthening them in their economic role as purchasers, workers, produce sellers, borrowers, housing applicants, tenants, etc(International Cooperative Alliance, 2014). According to (Henry, H., 2021) cooperatives are based on the values of self-help, self-responsibility, democracy, equality, equity, and solidarity. In the tradition of their founders, cooperative members believe in the ethical values of honesty, openness, social responsibility and caring for others. The cooperative principles are guidelines by which cooperatives put their values into practice. These principles are the following: Cooperatives are voluntary organisations, open to all persons able to use their services and willing to accept the responsibilities of membership, without gender, social, racial, political or religious discrimination. Cooperatives serve their members most effectively and strengthen the cooperative movement by working together through local, national, regional and international structures. Cooperatives work for the sustainable development of their communities through policies approved by their members (Henry, H., 2021). According to (European Parliamentary Research Service, 2019), there are 3 million cooperatives worldwide; together, they provide employment for 280 million people, equating to 10% of the world's employed population. The 300 largest cooperatives and mutuals in the world had a total turnover of US$2.018 trillion in 2016. In the EU there are some 131,000 cooperatives, with more than 4.3 million employees and an annual turnover of €992 billion.

For Africa, the cooperatives have played important role in the development of African countries. (Wanyama, F. O., 2019)indicated that promotion of these organizations to champion development has seen the history of cooperative development in independent Africa generally phased into two eras: the first era running from the immediate post-colonial period in the 1960's to the mid-1990s and the second era occurring during the global economic reforms from the mid 1990's to the present, which has been characterized liberalization of the economy. Whereas the first era was characterized by stringent government control over cooperative development through enactment of policies, legislation and programmes that promoted cooperatives as vehicles for accelerating national economic development, the second era has been the sphere of freeing cooperatives from the state to enjoy autonomy and operate like business ventures responding to market demands(Wanyama, F. O., 2019).

In Rwanda, (Mukarugwiza, S., 2010) showed that like in most African countries, cooperatives were first introduced in Rwanda by the Belgians in the colonial period as instruments for driving the agenda of the government's socio-economic goals. Due to the paternalistic approach of the colonial administration that sought to keep Africans in underprivileged positions, cooperatives were not considered to be attractive to Africans, as they restricted their activities to the social and agricultural sectors. Even in the agricultural sector, African cooperatives were strictly controlled by the colonial administration to the point of fixing the prices that cooperatives could pay their members for their produce, which was lower than what private European entrepreneurs paid (Wanyama, F., Develtere, P. and Pollet, I. , 2009). The end result of this scenario was that the cooperative movement witnessed little growth during the colonial period. However, the growth of the movement picked up at independence, following the support of the movement by the new

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government. According to (Ntavyohanyuma. P., 1987) there were only 4 cooperatives in Rwanda before 1962. The number increased to 36 between 1963 and 1966; it reached 423 between 1967 and 1973. It increased to 1203 between 1974 and 1980 and it reached 1523 between 1981 and 1983. From 2008 to 2023, cooperatives increased from 2500 (2008) to 10,408 cooperatives (Dec 2022). From 2018 to 2019, there was an increase of 8% (from 8,724 to 9,423) but from December 2019 to December 2020, the increase was 0.8%. In 2023, the statistics indicated that there are 11,019 cooperatives in Rwanda with 5,290,717 members. Those cooperatives pooled together more than fifty-four billion Rwanda francs (54,202,032,542 frw) as the total share capital of cooperative members(RCA, 2023).

Cooperatives play important role in the development of Rwanda. (Harelimana, J.B & Mukarukaka, B, 2021) Cooperatives are instruments used to alleviate poverty and to accelerate agricultural production in Rwanda. Similarly, cooperatives contribute to the achievement of the Millennium Development Goals, Vision 2020 and the Economic Development and Poverty Reduction Strategy (EDPRS) programme that focuses on rural economic trans formation, human resource development, development and promotion of theprivate enterprises and poverty alleviation. Cooperatives engaged in cash crop production, such as tea and coffee, play a major role in organizing producers to earn the country foreign exchange, which is an important contribution to the economy of the country. In 2007, agriculture's share of the GDP was approximately 37 per cent and the contribution of cooperatives to agricultural productivity was significant. Beside the above macro-economic role, cooperatives create decent employment for their members, especially in the handicraft and artisanal sector. Different crafts such as baskets are made across the country and are marketed by a large number of women's cooperatives. Different organizations, including ILO, GTZ and PPPMER have supported artisans in the informal economy and most of such artisans are organized into cooperatives. The union called "Kora" is one example of such a cooperative. Cooperatives create jobs not only for their members but also for their staff. According to the taskforce on promotion of cooperatives, each SACCO creates seven and half jobs, while other cooperatives create four jobs on average. From visits to unions and federations, it was established that each employs at least four individuals. Finally, cooperatives play an important role in financial intermediation in Rwanda. The National Bank that regulates 439 SACCOs as of 31-July-2022 including 23 non-Umurenge SACCOs and 416 Umurenge SACCO sin the country (National Bank of Rwanda, 2022).

Cooperative management in digital society: (Cousin,L. & Audebrand, L. K, 2019) showed that the beginning of 21st century has been marked by a rapid development of digital technologies, whose disruptive effects are affecting all economic sectors. The emergence of a collaborative economy has a particularly pressing effect on the cooperative movement: cooperative businesses, as democratic economic organizations, feel challenged by digital platforms able to connect distributed groups of people and enabling the exchange and sharing of resources in a cheap and efficient way (Cousin & Audebrand, 2019).

RESEARCH PROBLEM

(Ministry of Trade and Industry, 2018)outlined a series of issues of management in cooperatives in Rwanda namely: (i) Non-transparent decision-making process within cooperatives which lead to monopolization of decision by leaders, which can result into conflicts and misunderstanding between members and leaders on one hand and between members themselves on the other hand. (ii) Mismanagement of cooperative resources, due to poor financial management capacity, embezzlement of some cooperative leaders and employees, lack of transparency and limited accounting skills. (iii) Limited leadership, managerial, technical, IT and other soft skills required for effective management of cooperatives. This is mainly due to the low level of education on the side of cooperative leaders and managers of Cooperatives, which negatively impact the production capacity and growth of the cooperatives. (iv) Limited information and awareness of existing policies, laws and internal rules and regulations and decisions made within the cooperative movement (Confederation, Federations, Unions), creating disconnects between the leadership

and the membership base. (v) Lack of limitation in terms of members of a single family allowed to participate in one Cooperative, especially in decision-making committees. This needs to be addressed by the revised cooperative law. In addition, (Ministry of Trade and Industry, 2018) found limited use of ICT by cooperatives and yet ICT adoption as having the potential to have a significant impact on cooperatives' success in terms of access to information, extension services, markets, and finance. The overriding objective of National Policy on Cooperatives in Rwandais to enable the cooperative movement play its vital role towards the transformation of the national adoption of ICT: Increase the efficiency of the service delivery by the cooperative movement through automated services using ICT-based models and Cooperative Information Management System (CIMS); Improve the current management and accountability system in the overall structure of cooperative movement. MNK DIGITAL GROUP LTD, is a software developer and seller, which developed an IT Solution for the entire management (Cooperative Management System "CMS") of various cooperatives across the country and in different value chains. The software referred to here is called "Cooperative Management System (CMS)". Upon presentation, analysis and vulnerability study carried by Rwanda Information Society Authority (RISA), MNK system (CMS) got approved. RCA, as an entity overseeing cooperatives in Rwanda and referring to the law that requires all cooperatives to use IT solutions in their daily operations, recommended cooperatives to use the CMS in their business management. Since the software is approved by Rwanda Information Society Authority (RISA) and Rwanda Cooperative Agency (RCA), its adoption is challenging: the cooperatives may adopt it just to please the government that they are integrating ICT in their business and continue their routine of activities. This because the software was developed by the private company as a business and approved by the government for good functionality but it has not been proposed by the cooperatives as needed. The sustainability of this project is therefore challenging. All ICT systems do not satisfy the needs of the customers and end by being abandoned. The example is Windows Vista which did not last time in execution. Other home- made software serve for a time and end by being ineffective. CMS was introduced in 2019, and currently it is used by 146 Cooperatives in Rwanda. On the side of independent variable which is "Cooperative Management System (CMS)", the research would like to assess the extent to which the users appreciate the platform in terms of Information it contents, Career development process, user interaction, Technical aspects of the software and materials, and Support services it provides. On the side of dependent variable, which is "Efficiency and productivity of cooperatives", the research would like to assess the extent to which CMS contribute to the efficiency and productivity of cooperatives in Rwanda.

OBJECTIVES OF THE STUDY

The general objective of the research is to assess the Cooperative Management System (CMS) software and its impact on the efficiency and productivity of cooperatives in Rwanda. Specific objectives of the study are: (1) to evaluate the extent to which cooperative managers appreciate the design and functionality of Cooperative Management System (CMS); (2) to analyse the level of impact of CMS Membership management module on productivity and efficiency of cooperatives in Rwanda; (3) to assess the level of impact of CMS Payments management module on productivity and efficiency of cooperatives in Rwanda; (4) to find out the level of impact of CMS Accounting module on productivity and efficiency of cooperatives in Rwanda; (5) to determine the level of impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda; (6) to assess the level of impact of CMS Requisitioning module on productivity and efficiency of cooperatives in Rwanda; (7) to analyse the level of impact of CMS Credit management module on productivity and efficiency of cooperatives in Rwanda; and (8) to identify the challenges of Cooperative Management System (CMS) and provide recommendations.

RESEARCH HYPOTHESES

H0.1: Cooperative managers do not appreciate the design and functionality of Cooperative Management

System (CMS); H0.2: There is no significant impact of CMS Membership management module on productivity and efficiency of cooperatives in Rwanda; H1.1: There is significant impact of CMS Payments management module on productivity and efficiency of cooperatives in Rwanda; H0.3: There is no significant impact of CMS Accounting module on productivity and efficiency of cooperatives in Rwanda; H1.2: There is significant impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda; H0.4: There is no significant impact of CMS Requisitioning module on productivity and efficiency of cooperatives in Rwanda; H1.3: There is significant impact of Credit management module on productivity and efficiency of cooperatives in Rwanda.

STUDY SCOPE

Content scope

This study focus of "Cooperative Management System (CMS)" developed by MNK DIGITAL GROUP LTD as a pilot project of a software in 2019 and this system was officially recognised by Rwanda Cooperative Agency (RCA) and Rwanda Information Society Authority (RISA), the two regulatory bodies in cooperative sector in Rwanda. CMS reached currently 146 cooperatives operating in all provinces of Rwanda; and the project aimed at expanding. CMS offers 12 main services or modules namely: Membership management, Payment management, Accounting, Financial statements, Human resources, Requisitioning, Services rendered, Sales transaction, Credit management, Staffs site deployment, Invoicing, Reports, Employee supervision.

Geographical scope

This study was conducted on 146 cooperatives using Cooperative Management System (CMS) across Rwanda. These cooperatives operate in all 4 provinces of Rwanda (Eastern, Western, Northern, and Southern) and the City of Kigali more specifically in the following districts by province: Eastern province (Bugesera, Gatsibo, Kayonza, Kirehe, Ngoma, Nyagatare and Rwamagana districts); Western province (Nyabihu, Rusizi, Ngororero, Nyamasheke districts); Northern province (Rulindo district); Southern province (Huye, Ruhango, Gisagara, Kamonyi, Nyanza districts); and City of Kigali (Kicukiro, Gasabo districts).

Time Scope

Cooperative Management System (CMS) was introduced in 2019 as a pilot project that has to cover the entire country. The research covered the period of 5 years from 2019 up to 2023. This time is enough to assess the perceptions of managers of cooperatives on the CMS platform and its impact on productivity and efficiency. Some cooperative have 5 years of experience in using the platform, others have less than 5 years. Having diversified experience of cooperatives in terms of using the CMS allowed the researcher to get insight about how effective the software is by the users.

THEORETICAL REVIEW

General Systems Theory by Ludwig von Bertalanffy (in the 1940s)

According to (Chen, D & Stroup, W. M., 2021), General systems theory (GST; German: allgemeine Systemlehre) was coined in the 1940s by Ludwig von Bertalanffy, who sought a new approach to the study of living systems. Bertalanffy developed the theory via lectures beginning in 1937 and then via publications beginning in 1946. According to the theory, system management is the combination of four key elements which are all needed to manage a system efficiently and effectively: Inputs (Raw Materials, Human Resources, Capital, Information, Technology), process, output, feadback (Chen & Stroup, 2021). An

organization's input includes human resources, raw materials, physical resources, financial resources, equipment, technology, and information. The organizational process consists of processing inputs to make them the desired outputs. The process may include transformation, operation, planning, leadership, and management control. Output is the product of an organization. After successful processing, the output of an organization may be the desired product, service, employee behavior, productivity, profitability, loss, job satisfaction, etc. Organizational outputs are that customers consume perceive and provide feedback (Chih-Hui & Sapphire, 2017). In this line, (Adams, K., M., 2012) indicated that an organization as a system has various sub-systems such as its different business units, functional departments, employee groups, etc. They all are interconnected and interrelated to each other. Synergy describes the efforts of the whole as greater than the efforts of individual parts. The system approach ensures synergy in the organization. This approach suggests to management that an organization's subsystems should coordinate in such a way that the output should be always greater than the sum of the output of the individual subsystems. Feedback is an essential component of the management system to provide information regarding output. This is required for taking corrective actions in the organization if the results deviate from standard results (Adams, 2012).

Application of the theory to this research: A cooperative system is defined to be a system of multiple dynamic entities that share information or tasks to accomplish a common, though perhaps not singular, objective. A cooperative system is an integration of physical, biological, and social factors; its purpose is to overcome the limitations. As a cooperative system is established, it develops its own purpose and special organ to maintain itself. The purpose of a cooperative system is different from that of an individual's motives; a cooperative system becomes an independent entity and acquires its autonomy through having its own purpose. The conditions of survival for a cooperative system are effectiveness and efficiency, that is, to attain its purpose and satisfy individuals' motives respectively.

Cooperative Inputs: Inputs into cooperative consist of human resources (such as members, employees), raw materials (whatever the cooperative processes such as agricultural seed, fertilisers, land for the case of agricultural cooperative), physical resources (such as land and any other materials used), financial resources (such as members contribution, loan, donation), equipment (such as office equipment and operational equipment), technology (the use of ICT in modern society), and information (all systems used to share information about the day- to- day activities of the cooperative).

Process: This level consists of transformation of inputs into outputs which are desired results. Process consists of running a series of operations such as human resource management, suppliers' management, and effective usage of raw materials. This become successful if there is good planning, leadership, and management control.

Outputs: Cooperative's output may be the desired product depending on the activities of the cooperative, the service provided by the cooperative, employee or members' behavior, productivity, profitability, job satisfaction, etc. Cooperative's outputs are that customers consume perceive and provide feedback.

Cooperative Management System (CMS) and System Theory: CMS contributes fulfil the four key elements which are all needed to manage a system efficiently and effectively namely: Inputs (raw materials, human resources, capital, information, and technology), process, output, feedback. The user of CMS requires to input data from operation (such as information about the staffs, the vendors, the suppliers, the debt, the harvest, etc). CMS is made of database technology. The CMS process such data and provide information (output) timely in form of feedback.

EMPIRICAL REVIEW

(Teodosio, V., 2017)in a study titled "Agricultural Cooperatives and Information Communication Technology in an Emerging Asia" posited that technology is playing an increased role in agricultural

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cooperatives which exist in almost all the countries in Asia and enjoy legal recognition, through the interface of Internet and telecommunications to increase the amount of information available to cooperatives and their members. Nonetheless, their capacity to access and manage the data, information and knowledge differs from the level of information systems available and critical State support. The study highlighted that ICT applications from business to consumer have enabled cooperatives to identify products and marketing opportunities in the context of WTO implications while stressing that Asia has both very successful and those in dire trouble agricultural cooperatives. However, the study pointed out that there is a lot of knowledge sharing in the movement and this has helped tear down barriers between and among cooperatives. Many cooperatives which have their own customized systems, standard procedures and particular innovation have brought to life a wide range of good practices in agricultural cooperatives. The study discovered that Information communication technologies (ICTs) afford opportunities for a knowledge management system that proved sustainable for agricultural cooperatives. The study stated that the world has 8oo million cooperatives members and highlighted a number of successful agricultural cooperatives. In conclusion, the study stated that the cooperative sector in Japan has 30 million members; India with 236 million; South Korea, 5 million farmers, Thailand has 6 million members; Philippines, 5.6 million and Malaysia, 5.5 million and these countries have all added new sophistication in terms of a global projection for agricultural cooperatives because of communication technology (Teodosio, 2017).

(Ashrafi, R., & Murtaza, M., 2018)in their paper titled "Use and Impact of ICT on SMEs in Oman" conducted an exploratory study to learn about the use and impact of Information and Communication Technologies (ICT) on Small and Medium Sized Enterprises (SMEs) in Oman. They investigated ICT infrastructure, software used, driver for ICT investment, perceptions about business benefits of ICT and outsourcing trends of SMEs while providing an insight on the barriers for the adoption of ICT. Data on these aspects of ICT was collected from 51 SMEs through a survey instrument. They discovered that only a small number of SMEs in Oman are aware of the benefits of ICT adoption and that the main driving force for ICT investment was the need to provide better and faster customer service and to stay ahead of the competition. The study highlighted that majority of surveyed SMEs have reported a positive performance and other benefits byutilizing ICT in their businesses. Majority of SMEs outsource most of their ICT activities. Lack of internal capabilities, high cost of ICT and lack of information about suitable ICT solutions and implementation were some of the major barriers in adopting ICT (Ashrafi& Murtaza, 2018).

(International Cooperative Alliance- Africa, 2018) conducted a Review of the existing Information Communication Technologies (ICT) in co-operatives in Africa for the purpose of establishing a flexible, user-friendly Integrated Management Information System. On assessment of prevailing Record keeping System across the cooperatives, Findings show that manual operation is rife in cooperative administration across the study area. For instance, the highest incidence of manual record keeping obtains at the Secondary/Union tier at 48.62% hardcopy ledger-entry. Following close, in manual record keeping still, is the primary Tier at 23.03% incidentally, the mass of members who require timely services are within the Primary and Secondary cluster. The use of Ledger for record-keeping is relatively widespread at the sub-Apex federation level where the State/Regional Federation practice 16.21% manual entries and National Federation tend to fare better at 12.15%. The highest application of computer as a record keeping tool is seen at the National Federation/Country Apex Tier at 32.45%. Primary, Secondary and State/Provincial/Regional Federation Tiers make 23.35%, 22.57% and 21.63% application in record keeping, respectively. Remarkably, across the spectrum of cooperative Tiers, there is a growing size of trend blazers who keep records on online real-time basis on clouds. 26.54%, 18.95%, 27.25% and 27.25% are the cloud-based records for Primary, Secondary and State/Provincial/Regional Federation, respectively. These mixt of record keeping system still allow flexibility for a 'hybrid' which shows cooperative in the continent practicing a motley of record keeping system. The conclusion on the current record keeping system is; there are common record keeping trends across the study area. The trend speaks to the fact that these cooperatives are in a transitory mode; from predominantly manual mode towards automation and ICT. It can still be

better as there is room for improvement (International Cooperative Alliance- Africa, 2018).

On Data Automation System, while gauging the type of application used by cooperatives, a common, trend was observed. There is a high rate of 'undisclosed'. The lack of disclosure or inability to volunteer software name is suggestive of cooperative administrative system without an Accounting Application, or Information Management Application. The research found that there was a 69.30%, 58%, 55.56% and 15.87%% 'undisclosed' feedback for Primary, Secondary and State/Provincial/Regional Federation, respectively. The highest occurrence for Accounting Application is seen at the National Federation (at 84.13%). State/Regional Federations makes use of Accounting application more than Information Management Application at 33.33% to 11.11%. The Conclusion; Accounting Application lacks the depth and flexibility to provide solution-as-service to manage members records. Interestingly, it ranks second in percentile frequency to undisclosed. Information Management Application are better tuned to serve MIS- Management Information System role (International Cooperative Alliance- Africa, 2018).

(Oyebanjo, O., 2020) examined factors affecting information technology (IT) adoption and its effect on cooperative performance in Egba Division, Ogun State, Nigeria. Primary data were collected from 122 respondents by multi-stage sampling techniques through questionnaire. Data were analysed by descriptive statistics, Binary Logit and Cobb-Douglas function. The result shows that average respondent was 32.8 years old. Male (80.3%) dominated cooperative management, 64.8% were married, 31.2% had maximum of secondary education. Cooperative membership was 10 – 58 persons. The factors determining the use of Information technology (IT) among cooperatives in the study area were examined by the Binary Logit model. The dependent variable in this analysis is adoption status of computer system (i.e. adopted or non-adopted) being the major information technology i.e. hardware that is used to operate the software, internet and social media. The estimates of the analysis are presented in Table 4. The model parameters i.e. chi square and log likelihood values were significant at ($P<0.01$) probability level showing that the model has significant explanatory power of the data. The value of pseudo-R2 (0.7497) shows a good fit of the model. The value means that 74.9% of the variation in information technology (IT) adoption among the cooperatives was caused by the explanatory variables in the analysis while remaining 25.1% could be attributed to unknown factors. The estimated coefficient of age (-0.0337) of the cooperative manager had a significant negative relationship with IT adoption at $p < 0.01$. This implies that age of the managers does not support the use of IT facilities. This may be due to their unwillingness to go back to class for computer training. Thus, youthful managers are likely to be willing for new training which will favour IT adoption in cooperative. Educational level of the managers had a positive and significant coefficient (0.2956) at $p < 0.01$ indicating that higher level of education will promote adoption of IT facilities among the cooperatives. The coefficient of membership (0.0358) significantly influenced adoption of IT facilities at $p< 0.01$. The positive sign indicates that an increase in membership will enhance the use of IT facilities by the cooperatives through additional funds. The coefficient of gender (0.4324) is positive and significant at $p < 0.05$. The coefficient value is significantly not different from zero implying that female managers contributed more to the use of IT facilities by the cooperatives. This finding supports the fact that female dominates secretariat job than male workers. Experience has a positive and significant coefficient (0.0607) at $p < 0.01$, implying that appreciable years in cooperative management will encourage effective use of IT facilities. However, the coefficient of manger's computer literacy (0.9399) shows a positive and significant relationship with IT adoption. Thus, adequate knowledge in computer operation is a prerequisite for adoption and effective use of computer system and other related facilities (Oyebanjo, 2020).

In Kenya, several researchers indicated how poor adoption of ICT led cooperatives to decline in favour of banks. (Onduko, G., 2013) indicated that SACCOs and other MFIs in the financial sector in Kenya risk closure and redundancy if they are not able to embrace innovative technology to counter the ever-rising competition from the commercial banks. The Savings and credit cooperative societies are faced with challenges of survival due to decline of members despite their geographical spread compared to other

financial providers in the country (Onduko, 2013). (Mabrouk, A., & Mamoghli, C, 2015) showed that this trend in loss of customers is attributed to the competition from banks, which have embraced financial innovations thus being able to offer better services like easy access transaction accounts and consumer loans through mobile and internet platforms. This scenario has sparked off stiff competition for customers between Savings and credit cooperative society and these other Financial Institutions (Mabrouk & Mamoghli, 2015). In the same line, (Otieno,D. J. , 2016) found that deposits taking SACCO's in Kenya have always straggled to keep pace with this ever-changing technology with some of the SACCOs collapsing and others operating under losses. Long lines due to increased membership, transaction error, and insecurity and network failures are the common challenges in the financial markets. This has highly lowered customer's perception on the quality of service offered, reducing credibility in the banks and microfinance. Majority of Savings and credit cooperative societies' growth in Kenya is decimal. Many of them still do not have Front Office Services Activity. How to strategize for financial innovation basing on the available resources to attain growth has become a great challenge. There is clear inadequacy of financial innovation among Savings and credit cooperative societies in Kenya(Otieno, 2016).

(Wachira, D., Muturi, P., & Sirma, J., 2014)in their study titled "An Evaluation of the Perceived Effect of ICT's on the Performance of Savings and Credit Co-operatives (SACCOs) in Kenya", they explained that competitiveness of firms in the context of the current economic challenges requires effective management activities and a strategic importance directed towards a better administration of knowledge and the impact of Information and Communication Technology on organizational structures. The study sought to evaluate the perceived effects of ICT on performance of Sacco's in Kenya through a census survey of 34 licensed Sacco's in Nairobi County. The study specifically evaluated the prospects of ICT in Sacco's in meeting their stated objectives, the level of awareness in Kenya, the levels of innovations, existing infrastructure, integration of the cooperative processes and the perception amongst the stakeholders. Their study focused on the perceived ICT factors towards performance such as innovations, infrastructure, awareness and policies. They did a comparative case study selected from different social economic settings and employed a survey research design. Data was collected using questionnaires to provide an insight into the phenomena. They concluded that Sacco's should combine their 'hard' ICT investments (i.e. acquisition of new hardware, software and networks), with appropriate 'soft actions', in order to achieve higher levels of benefits and impact on business performance from them. One of these necessary 'soft actions' is the alignment of ICT investment to business strategy, which results in the selection of the most appropriate ICT investments that support to the highest possible extent the selected business strategy and action plan of the firm, and therefore leads to a higher level of ICT benefits and business impact. Firms who perceive use of ICT as beneficial, non-complex, compatible and of low risk to use are more likely to adopt ICT in day to day business. This is compatible with previous studies illustrating that the main barriers to ICT adoption are simply the concern that the ICT would not lead to more efficiency, lower costs or more revenues. Consistent with previous research, the study also revealed that ICT skills and knowledge can crucially increase its adoption. They recommended that SACCO should conduct a thorough strategic Plan to illustrate how market forces can compel the Sacco's to make radical shifts in their organizational environment and culture; that Sacco should align ICT Plans with Business Plans and conduct reengineering studies and develop strategic ICT plans to align key ICT needs with those of the business (Wachira, Muturi & Sirma, 2014).

CONCEPTUAL FRAMEWORK

(Kapoor, R., 2022) referred to the definition of Merriam-Webster Dictionary, according to which a paradigm is "a philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated." 1 As applied in the context of research, a research paradigm is a worldview or philosophical framework, including ideas, beliefs, and biases, that guides the research process. The research paradigm in which a study is situated helps determine the manner in which the research will be conducted. The research

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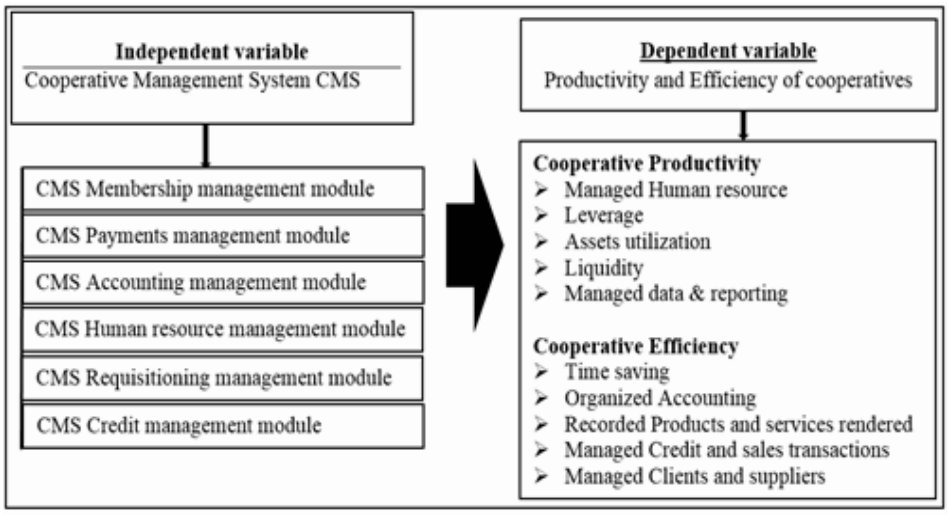
paradigm is the framework into which the theories and practices of your discipline fit to create the research plan. This foundation guides all areas of your research plan, including the aim of the study, research question, instruments or measurements used, and analysis methods. The research paradigm framework is supported by three pillars: ontology, epistemology, and methodology. The one applied in this research is Methodology which is the study of how one investigates the environment and validates the knowledge gained. It attempts to answer the question "how to go about discovering the answer/reality." Addressing this pillar leads to specific data collection and analysis plans (Kapoor, 2022). In this line, the variables of the research and their relationship are schematised as by the figure 51. Independent variable is Cooperative Management System under which the research assessed six core modules namely: Membership management, Payment management, Accounting management, Human resource management, Requisitioning management, and Credit management. Depending variables is Productivity and efficiency of cooperative where under Productivity the research analysed variables such as Time saving, Risks reduction, Easy reporting, Loss mitigation, and Quality data management. Under Efficiency, the research assessed variables such as Human resource management, Organized Accounting, Products and services rendered records, Credit and sales transactions management, and Clients and suppliers management.

Figure 1: Research Framework



Source: Author, 2022.

RESEARCH METHODOLOGY

Research design

This research is descriptive and it mixes qualitative and quantitative approaches. (Nassaji, H., 2019)defines descriptive research design as a type of research design that aims to obtain information to systematically describe a phenomenon, situation, or population. It answers the what, when, where, and how questions regarding the research problem, rather than the why; it measures data trends by measuring changes in variables over a period of time, allowing trends to be identified and analysed; it compares variables as well as how different demographics respond to different variables; it define the characteristics of subjects such as opinions, traits, and behaviour; it verifies or validates existing conditions when conducting an in-depth analysis of every variable before drawing conclusions.Descriptive research can utilize elements of both quantitative and qualitative research methodologies, often within the same study (Nassaji, 2019). As qualitative research, this research gathered the opinions of respondents about research variables using a questionnaire designed in form of five levels Likert scale where the scale of measurement was 1= Unsatisfactory; 2= Poor; 3= Satisfactory; 4= Good; and 5= Outstanding.

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Research population

The total population of this research is 61,320 members of 146 cooperatives using Cooperative Management System (CMS) in the following districts by Province of Rwanda: Eastern province (Bugesera, Gatsibo, Kayonza, Kirehe, Ngoma, Nyagatare and Rwamagana districts); Western province (Nyabihu, Rusizi, Ngororero, Nyamasheke districts); Northern province (Rulindo district); Southern province (Huye, Ruhango, Gisagara, Kamonyi, Nyanza districts); and City of Kigali (Kicukiro, Gasabo districts).At these members, the research involved 19 District Cooperatives Officers and the Director of Cooperatives Promotion and Capacity Building Unit in Rwanda Cooperative Agency (RCA) (1). Therefore, the total population of the study is 61340.

Sampling techniques

This research applied probability sampling methods where all 146 cooperatives had equal chance of being selected and they were all involved in the research. Under probability sampling, this research used two techniques namely cluster sampling and simple random sampling. By cluster sampling, the research subdivided the entire population of 61320 cooperative members into 5 clusters namely the cluster of Presidents, the cluster of Managers (or accountants), the cluster of Suppliers, the cluster of Members, and the cluster of Local leaders (Districts and RCA). The clusters of Presidents as well as the cluster of Managers (or accountants) were taken as a whole. Meaning that all presidents and managers (accountant) of 146 cooperatives were involved in the research. These are very key since the accountants are the ones to run day- to- day CMS through recording the data and producing reports, and the Presidents are the supervisors of the system to certify its efficiency and productivity. For the cluster of Suppliers and the cluster of Members, the research applied deliberate sampling and only considered 1 Supplier and 2 Members. One supplier to provide information about how suppliers are served and 2 members to assess the change brought by the system into cooperative management. People with advanced experience working with the target cooperatives were prioritised. For the cluster of local leaders, the research involved the 19 District Cooperatives Officers corresponding to 19 districts. These are the technicians following day- to- day the activities and the progress of the cooperatives. Rwanda Cooperative Agency (RCA) was represented by the Director of Cooperatives Promotion and Capacity Building Unit.

Sample size

At cooperative level, the research was conducted on 5 persons namely: the president (1), the manager (or accountant) (1), supplier (1), members (2). In sum, the individual respondents to the research totalised 730. These respondents answered to the questionnaire. Other people involved in the research are the District Cooperatives Officers (19) and Director of Cooperatives Promotion and Capacity Building Unitin Rwanda Cooperative Agency (RCA) (1). These 20 leaders were interviewed. Therefore, the sample population of the research was 750 respondents.

Data collection procedures

For collecting the data, the researcher prepared a questionnaire as well as the interview guide. The research prepared an application letter to the Mayors of the districts requesting the authorisation to reach the target population. The questionnaire was attached to the letter and deposited to the reception waiting for the approval. Once the approval was accepted, a call was received from the receptionists and the researcher responded by attending to the office of the Mayors of the districts who connected the researcher to the District Cooperatives Officers for smooth research process. The survey was then conducted and the data was collected.

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Data collection instruments

***Questionnaire*:** (Roopa, S. & Satya, R. M., 2017)define a questionnaire as a research instrument consisting of a series of questions for the purpose of gathering information from respondents (Roopa & Satya, 2017). This research used a questionnaire designed in form of five levels Likert scale where the scale of measurement was: 1 = Unsatisfactory; 2 = Poor; 3 = Satisfactory; 4 = Good; 5 =Outstanding.

KoBo Toolbox: (Joe, A., 2022) describes KoBo Toolbox as a free open-source tool for mobile data collection, available to all. It allows you to collect data in the field using mobile devices such as mobile phones or tablets, as well as with paper or computers. Acknowledging that many agencies are already using ODK, a de facto open-source standard for mobile data collection, KoBo Toolbox is fully compatible and interchangeable with ODK but delivers more functionality such as an easy-to-use form builder, question libraries and integrated data management. It also integrates other open-source ODK-based developments such as form hub and Enketo. All humanitarian actors can create accounts on the dedicated server and use them without limitations on data or time. Organisations can also install it on their own servers or directly contribute to its further development (Joe, 2022). In this research, KoBo Toolbox was used by collecting data using tablets. The tool provides reports of analysis and data can be exported into SPSS for further analysis.

Validity and reliability

Validity consists of the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform. Reliability, on the other side, consists of the consistency, stability and repeatability of the results. These tests aim at showing the validity and the reliability of the research instrument (the questionnaire) before administrating it to the target population. Therefore, this research used piloting (Teijlingen, E. R. V. & Hundley, V. , 2018) by administrating the questionnaire to a sample of 3 cooperatives of Nyagatare districts and the results were tested for validity and reliability. For validity, the research used content validity test recommended by (Yaghmale, 2013) Yaghmale (2003) and analysed four key elements namely: relevance, simplicity, clarity, and ambiguity using a checklist outlined in table 1.

Table 1: Validity test checklist

1. Relevance		3. Simplicity	
1	Not relevant	1	Not simple
2	Item need some revision	2	Item need some revision
3	Relevant but need minor revision	3	Simple but need minor revision
4	Very relevant	4	Very clear
2. Clarity		4. Ambiguity	
1	Not clear	1	Doubtful
2	Item need some revision	2	Item need some revision
3	Clear but need minor revision	3	No doubt but need minor revision
4	Very clear	4	Meaning is clear

Source: Yaghmale (2013).

For testing the reliability, the researcher computed the Cronbach's Alpha coefficient using SPSS and as indicated by the table 3. 2 and the results was 81.7% indicating that the tool is reliable. In fact as indicated

by (Teijlingen, E. R. V. & Hundley, V. , 2018), Cronbach's Alpha (α) >= 0.9 indicates excellent reliability; 0.89 >α >= 0.80 indicates good reliability; 0.79 >α >= 0.70 indicates acceptable reliability; 0.69 >α >= 0.60 indicates a questionable reliability; 0.59 >α >= 0.50 indicates poor reliability; while α < 0.50 indicates unacceptable reliability (Teijlingen & Hundley, 2018).

Table 2: Reliability Statistics

Cronbach's Alpha (α)	N of Items
.817	5

Source: Field data (2022).

Data analysis

The data processing lead to analysis of data. This research used KoBo Toolbox and IBM SPSS Statistics Version 23. Two types of statistics were applied namely descriptive statistics and inferential statistics.

Descriptive statistics

According to (Yellapu, V. , 2018) and (Fatih, O., 2022)descriptive statistics are used to describe the basic features of the data in a study. They are used to present quantitative descriptions in a manageable form. They include: measures of frequency such as frequency and percentage; measures of central tendency such as mean; measures of dispersion or variation such as standard deviation; and measures of variability such as kurtosis, and skewness (Yellapu, 2018; Fatih, 2022). This research used descriptive statistics in analysing independent variable (CMS) (while assessing its appreciation by the users) as well as analysing Productivity and efficiency of cooperatives through CMS. The results are presented in form of frequency, percentages, minimum, maximum, mean, and standard deviation. The interpretation is based on the mean and standard deviation. As indicated by (Warmbrod, J. P., 2014) and (Lee, D. K., Junyong, I. & Sangseok, L. , 2015), the mean between 1 and 1.80 represents (strongly disagree), the mean between 1.81 until 2.60 represents (do not agree), the mean between 2.61 and 3.40 represents (true to some extent), the mean between 3:41 and 4:20 represents (agree), and the mean between 4:21 and 5:00 represents (strongly agree). Considering the standard deviation, a standard deviation close to zero indicates that data points are close to the mean, whereas a high or low standard deviation indicates data points are respectively above or below the mean (Warmbrod, 2014; Lee, Junyong, Sangseok, 2015). In this study, the distributions with a coefficient of variation higher than 1 are considered to be high variance whereas those with a coefficient of variation lower than 1 are considered to be low-variance and they indicate homogeneity of answers.

Inferential statistics

This research applied regression analysis which is a powerful statistical method that allows to examine the relationship between two or more variables of interest namely Cooperative Management System (CMS) (CMS Membership management module, CMS Payments management module, CMS Accounting management module, CMS Human resource management module, CMS Requisitioning management module, and CMS Credit management module) and Productivity (Managed Human resource, Leverage, Assets utilization, Liquidity, Managed data & reporting) and Efficiency of cooperatives (Time saving, Organized Accounting, Recorded Products and services rendered, Managed Credit and sales transactions, Managed Clients and suppliers) in the context of this research.

Model specification

The research model and methods of data analysis applied are the following:

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$CooProd\_\&Effi = \beta_0 + \beta_1 CMSMembMgtMod + \beta_2 CMSPayMgtMod + \beta_3 CMSAccMgtMod + \beta_4 CMSHrMgtMod + \beta_5 CMSRequisMgtMod + \beta_6 CMSCreditMgtMod + \varepsilon.$

Where: CooProd_&Effi indicates Cooperative productivity and efficiency which is a dependent variable (Y); β_0 = intercept; β_{1-5} indicatesthe slope for the population model; CMSMembMgtMod = Cooperative member management module; CMSPayMgtMod = Cooperative payment management module; CMSAccMgtMod = Cooperative accounting management module; CMSHrMgtMod = Cooperative human resource management module; CMSRequisMgtMod = Cooperative requisitioning management module; CMSCreditMgtMod = Cooperative credit management module; ε = other factors.

Goodness of fit test (R^2)

According to (Maydeu-Olivares, A. & Forero, C. G., 2014), Goodness-of-fit tests determine how well sample data fit what is expected of a population. From the sample data, an observed value is gathered and compared to the calculated expected value using a discrepancy measure. R-squared is a goodness-of-fit measure for linear regression models. (Sarstedt, R. & Mooi, M. , 2014), state that these statistics show how well the model the researcher is testing explains the data: How much variance in the dependent variable is explained by the combination of the predictors? R^2 (or adjusted R^2) is used to determine the overall amount of variance in the dependent variable that is explained by all the predictor variables in combination. An R^2 of 1 indicates that the regression predictions perfectly fit the data (Maydeu-Olivares &Forero, 2014). This research applied this test to check whether the model fit the data. The decision rules for R^2 are the following: if R-squared value < 0.3 this value is generally considered a None or Very weak effect size, if R-squared value $0.3 < r < 0.5$ this value is generally considered a weak or low effect size, if R-squared value $0.5 < r < 0.7$ this value is generally considered a Moderate effect size, if R-squared value $r > 0.7$ this value is generally considered strong effect size (Moore, D. S., Notz, W. I, & Flinger, M. A., 2013).

Analysis of Variances (ANOVA) test

According to (Sawyer, S., 2019), ANOVA test was developed by Ronald Fisher in 1918 to extend the t and the z test which have the problem of only allowing the nominal level variable to have two categories. This test is also called the Fisher analysis of variance. ANOVAs are used in three ways: one-way ANOVA, two-way ANOVA, and N-way ANOVA. A one-way ANOVA has just one independent variable. A two-way ANOVA (are also called factorial ANOVA) refers to an ANOVA using two independent variables. An n-way ANOVA (with n being the number of independent variables). The null hypothesis for an ANOVA is that there is no significant difference among the groups. Therefore, if the results of ANOVA test are significant (p- value<0.05), we reject the null hypothesis, and we accept alternative hypothesis. In ANOVA results there are two residuals. A residual being the difference between the observed value and the mean value that the model predicts for that observation. Residual values are especially useful in regression and ANOVA procedures because they indicate the extent to which a model accounts for the variation in the observed data. The two residuals in ANOVA are: residual between group and residual within groups (Sawyer, 2019).

Parameter estimates test

(Sarstedt, R. & Mooi, M. , 2014) state that parameter estimates (also called coefficients) are the change in the response associated with a one-unit change of the predictor, all other predictors being held constant. The parameter estimates table summarizes the effect of each predictor. There are two types of estimates for each population parameter namely the point estimate and confidence interval (CI) estimate. P-values and coefficients in regression analysis work together to indicate which relationships in the model are statistically significant and the nature of those relationships. The coefficients describe the mathematical relationship

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between each independent variable and the dependent variable. The p-values for the coefficients indicate whether these relationships are statistically significant. The sign of a regression coefficient tells whether there is a positive or negative correlation between each independent variable and the dependent variable. A positive coefficient indicates that as the value of the independent variable increases, the mean of the dependent variable also tends to increase (Sarstedt & Mooi, 2014).

HYPOTHESIS TESTING

Diagnostic tests

Multiple regression analysis is based on five assumptions namely: linearity, no auto-correlation, multicollinearity, normality, and homoscedasticity. Before running regression, the research tested whether none among these assumptions were violated. The test below indicates the results of tests executed to assess the no violation of multiple regression assumptions.

Linearity test: Since multiple regression analysis is based on the assumption that the independent variables are not correlated with one another, it was therefore necessary to verify the correlation between the independent variables before running the regression analysis. Pearson correlation test was used to assess the correlation among variables. The results indicated that the assumption of linearity was not violated. Thus there is no correlation among variables as indicated by the correlation matrix presented as table 4.5.

Autocorrelation test: Autocorrelation refers to the degree of correlation of the same variables between two successive time intervals. It measures how the lagged version of the value of a variable is related to the original version of it in a time series. Autocorrelation, as a statistical concept, is also known as serial correlation.Autocorrelation can cause problems in conventional analyses (such as ordinary least squares regression) that assume independence of observations. The research tested whether there is no autocorrelation among variables using the Durbin Watson statistic which is a test for autocorrelation in a regression model's output. The Durbin Watson statistic ranges from 0 to 4, with a value of 2.0 indicating zero autocorrelation. The Durbin-Watson statistic value between 1.5 and 2.5 indicates that the data is not autocorrelated. For this study, the Dubin-Watson statistic value is 1.910 and thus it suggests the model is robust. There is no autocorrelation among variables. The research find therefore that the assumption of no autocorrelation is not violated as indicated by the table 4.23.

Table 4.1: Autocorrelation test results

Model Summary[b]	
Model	Durbin-Watson
1	1.910[a]
a. Predictors: (Constant), CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtModCMSRequisMgtMod, CMSCreditMgtMod	
b. Dependent Variable: CooProd_&Effi	

Source: Field data (2022).

Multicollinearity test: Multicollinearity is the occurrence of high intercorrelations among two or more independent variables in a multiple regression model. It exists whenever an independent variable is highly correlated with one or more of the other independent variables in a multiple regression equation. Multicollinearity is a problem because it undermines the statistical significance of an independent variable. To detect multicollinearity this research used a metric known as the Variance Inflation Factor (VIF), which measures the correlation and strength of correlation between the predictor variables in a regression model.

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The results indicated that the VIF results are between 1.661 and 1.274 (below 5) for all the variables; while tolerance is between 0.785 and 0.602 (above 0.2). Such VIF and tolerance diagnosis signify that there is no threat of multicolinearity as the rule of thumb states that VIF should be between 1 and 5; and tolerance should not be below 0.2 (Daoud, 2017). These results indicate that there is no violation of multicollinearity which is the third assumption of multiple linear regression as presented in table 4.24.

Table 4.2: Multicollinearity test results

Model		Collinearity Statistics	
		Tolerance	VIF
1	CMSMembMgtMod	.336	2.976
	CMSPayMgtMod	.427	2.342
	CMSAccMgtMod	.519	1.927
	CMSHrMgtMod	.355	2.817
	CMSRequisMgtMod	.841	1.189
	CMSCreditMgtMod	.391	2.558
a. Dependent Variable: CooProd_&Effi			

Source: Field data (2022).

Normality test: For testing the variables for normality, two tests were applied: Kolmogorov-Smirnova and Shapiro-Wilk tests. As the dataset for this research is 115 and therefore greater than 100, the results are checked on the side of Kolmogorov-Smirnova results. The rule of thumb for these tests state that if the Significance value of the Kolmogorov-Smirnova test is greater than 0.05 ($p>0.05$, or not significant), the data is normal; else if it is below 0.05, the data significantly deviate from a normal distribution. As indicated by the table 4.25, the p- value for all variables are greater than 0.05; they are statistically not significant. They are therefore normally distributed. This finding leads to affirm that the assumption of normality is not violated.

Table 4.3: Normality test results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CMSMembMgtMod	.421	730	.210	.355	730	.143
CMSPayMgtMod	.317	730	.165	.524	730	.407
CMSAccMgtMod	.184	730	.320	.467	730	.222
CMSHrMgtMod	.219	730	.158	.666	730	.324
CMSRequisMgtMod	.134	730	.240	.721	730	.521
CMSCreditMgtMod	.139	730	.193	.359	730	.264
a. Lilliefors Significance Correction						

Source: Field data (2022).

Homoscedasticity test: Homoscedasticity, or homogeneity of variances, is an assumption of equal or similar variances in different groups being compared. Homoscedasticity refers to a condition in which the variance of the residual, or error term, in a regression model is constant. That is, the error term does not vary much as the value of the predictor variable changes. If heteroskedasticity exists, the population used in the regression contains unequal variance, the analysis results may be invalid. To test for homoscedasticity, the

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research applied Levene's test of equality of error variances and the results show that Levene's Test of Equality of Error Variances resulted in non-significant data with p- value = 0.413 (p- value> 0.05). Thus the results indicates that this assumption is not violated as the p- value >0.05 as presented in the table 4.26.

Table 4.4: Homoscedasticity test results

Levene's Test of Equality of Error Variances[a]			
Dependent Variable: CooProd_&Effi			
F	df1	df2	Sig.
.575	726	4	.412
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.			
a. Design: Intercept + CMSMembMgtMod + CMSPayMgtMod + CMSAccMgtMod + CMSHrMgtMod + CMSRequisMgtMod + CMSCreditMgtMod			

Source: Field data (2022).

Inferential statistics

The previous tests found that all five assumptions of multiple linear regression are not violated. It is therefore now the time for running regression analysis. Multiple linear regression is used to predict the value of a variable based on the value of another variable or other variables for the present case. The variable that the research wants to predict is called dependent variable (or sometimes, the outcome variable). The variable that the research are using to predict the other variable's value is called the independent variable (or sometimes, the predictor variable). The results of multiple linear regression are summarised in three main tables namely parameters estimates (or regression coefficients) outlining the model coefficients and outlining the results of testing hypothesis by indicating the significance level of the relationship between individual independent variables and dependent variable; the model summary indicating the goodness of fit (R^2), the Analysis of Variance (ANOVA) which is a statistical technique that is used to check if the means of two or more groups are significantly different from each other. ANOVA checks the impact of one or more factors by comparing the means of different samples.

Correlation matrix

The table 4.5 provides three main information: Pearson correlation results (r), Significance of the correlation (sig.), and Correlation sign (+ or -). **Pearson correlation results (r):** For Pearson correlation results, the rule of thumb indicates that the correlation coefficient r<0.25 indicates no correlation; the 0.26<r<0.5 indicates weak correlation; the 0.5<r<0.75 indicates moderate correlation; and 0.75<r<1.0 indicates strong correlation. In this line, the table 4.27 shows that there is no correlation among all variables since no variable has a value greater than or equal to 0.25. **Significance of the correlation (sig.):** Concerning the significance of the correlation (sig.), the p- value <0.05 indicates that the relationship is significant, which means that such relationship exist not only in the sample size (selected financial institutions) but also in entire population (all financial institutions). Where the p- value>0.05 (not significant), this indicates that the relationship exists only in sample size and not in the entire population. The results presented in table 4.27 indicate that the relationship is significant since all p- value <0.05. **Correlation sign (+):** The positive sign indicate there is positive correlation among variables since the correlation coefficient for all variables are greater than zero (+) which means that two variables tend to move in the same direction so that when one variable tends to decrease as the other variable decreases, or one variable tends to increase when the other increases.

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Table 4.5: Correlation Matrix

		CMSMemb MgtMod	CMSPay MgtMod*	CMSAcc MgtMod*	CMSHr MgtMod*	CMSRequis MgtMod*	CMSCredit MgtMod*	CooProd_ &Effi
CMSMemb MgtMod	Pearson Correlation	1	.023	.092	.106	.398	.198	.025
	Sig. (2-tailed)		.031	.041	.048	.001	.011	.028
	N	730	730	730	730	730	730	730
CMSPay MgtMod	Pearson Correlation	.023	1	.030	.076	.043	.243	.190
	Sig. (2-tailed)	.031		.015	.036	.027	.091	.046
	N	730	730	730	730	730	730	730
CMSAcc MgtMod	Pearson Correlation	.092	.030	1	.102	.098	.198	.209
	Sig. (2-tailed)	.041	.015		.006	.023	.088	.038
	N	730	730	730	730	730	730	730
CMSHr MgtMod	Pearson Correlation	.106	.076	.102	1	.139	.339	.210
	Sig. (2-tailed)	.048	.036	.006		.054	.067	.036
	N	730	730	730	730	730	730	730
CMSRequis MgtMod	Pearson Correlation	.398	.043	.098	.139	1	.308	.210
	Sig. (2-tailed)	.001	.027	.023	.054		.001	.036
	N	730	730	730	730	730	730	730
CMSCredit MgtMod		.198	.243	.198	.339	.308	1	.028
		.011	.091	.088	.067	.001		.001
		730	730	730	730	730	730	730
CooProd_ &Effi	Pearson Correlation	.025	.190	.209	.065	.210	.028	1
	Sig. (2-tailed)	.028	.046	.038	.021	.036	.001	
	N	730	730	730	730	730	730	730

* (CMSMembMgtMod = Cooperative member management module; CMSPayMgtMod = Cooperative payment management module; CMSAccMgtMod = Cooperative accounting management module; CMSHrMgtMod = Cooperative human resource management module; CMSRequisMgtMod = Cooperative requisitioning management module; CMSCreditMgtMod = Cooperative credit management module; and CooProd_&Effi= Cooperative productivity and efficiency).

Source: Field data (2022).

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Regression Analysis

This Section outlines four key results namely the results of hypothesis testing, model summary, and analysis of variance.

Hypothesis testing results

β_0Coefficient

The table 4.7 shows that the intercept value β_0= 0.068which predicts that the value of CooProd_&Effiwill be equal to 0.068 when all of the independent variables are equal to zero.

$H_0$1: Cooperative managers do not appreciate the design and functionality of Cooperative Management System (CMS).

The results of descriptive statistics on overall appreciation of CMS by cooperatives managers indicated that the level of overall appreciation of CMS by cooperative managers is "Good" ($\bar{x}$= 3.8; σ = .270). Information in CMS is good ($\bar{x}$=4.0; σ =.440); Career development process through CMS ($\bar{x}$=3.2; σ =.280); CMS user interaction ($\bar{x}$=4.5; σ =.320); CMS Technical aspects of the software and materials ($\bar{x}$=3.1; σ =.260); CMS Support services ($\bar{x}$=4.1; σ =.060). These results indicate that all axes evaluated have an average mean $\bar{x}$>3.0 and standard deviation σ<1.0 which indicate that cooperative managers do appreciated the CMS design and functionality. Therefore, the Null hypothesis was rejected and the study concluded that Cooperative managers do appreciate the design and functionality of Cooperative Management System (CMS). This implies that CMS design and functionality is good. Interviewed respondents supported these results by affirming that CMS is easy to use and it integrate all aspects of the cooperative management that it reduced the tasks accomplished by cooperative staffs.

Table 8: Overall respondents' appreciation of CMS

CMS Evaluation criteria	N	Min	Max	$\bar{x}$	σ
Information in CMS	730	2.8	4.4	4.0	.440
Career development process through CMS	730	2.2	3.6	3.2	.280
CMS user interaction	730	3.8	5	4.5	.320
CMS Technical aspects of the software and materials	730	2.6	3.2	3.1	.260
CMS Support services	730	3.8	4.4	4.1	.060
Valid N (listwise)	**730**	**3.04**	**4.12**	**3.8**	**.27**

Source: Field data (2022).

$H_0$2: There is no significant impact of CMS Membership management module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.7 revealed that CMS Membership management module was positive and significant (β_1= 0.049; p< 0.05). Therefore, the null hypothesis was rejected and the study concluded that CMS Membership management module is positive and exercise significant impact on productivity and efficiency of cooperatives in Rwanda. This implies that there was up to 0.049 units increase in Cooperative productivity and efficiency for each unity increase in CMS Membership

management module holding all other independent variables constant.

These findings are consistent with (Magpili, N. C. & Pazos, P., 2019) who found that Membership management software is a specialized solution for centralizing administrative and communication activities of a membership organization. The software creates a digital space where community members can interact with managers and with each other, and where all organizational issues can be solved. The core objective of such a solution is to share information between community members without delays, thus streamlining all organizational processes. (Magpili & Pazos, 2019). These results are supported by the General system theory according to which human resoitrces are the key inputs into organization to get better outputs. (Chih-Hui L. & Sapphire, L., 2017) outlined 4 components of system theory namely input, process, output, and feedback. Input is the first step of the system approach. An organization's input includes human resources, raw materials, physical resources, financial resources, equipment, technology, and information. The organizational process consists of processing inputs to make them the desired outputs. The process may include transformation, operation, planning, leadership, and management control. Output is the product of an organization. After successful processing, the output of an organization may be the desired product, service, employee behavior, productivity, profitability, loss, job satisfaction, etc. Organizational outputs are that customers consume perceive and provide feedback (Chih-Hui & Sapphire, 2017).

H_1.1: There is significant impact of CMS Payments management module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.7 revealed that CMS Payments management module was positive and significant (β_2= 0.258; p< 0.05). Therefore, the alternative hypothesis was accepted and the study concluded that CMS Payments management module exercises significant impact to Cooperative Productivity and efficiency. This implies that there was up to 0.258 units increase in Cooperative productivity and efficiency for each unity increase in CMS Payments management module holding all other independent variables constant.

These findings are consistent with the research of (Mustapha, S. A., 2018)in his study "E-Payment Technology Effect on Bank Performance in Emerging Economies–Evidence from Nigeria" where he showed that Alternative Payment Model (APM) is a payment approach that gives added incentive payments to provide high-quality and cost-efficient care. APMs can apply to a specific clinical condition, a care episode, or a population. Mobile Money Transfer (Mobile) is another electronic payment platform that was given high priority by this study (Mustapha, 2018). These findings are supported by Administrative Management Theory by Henri Fayol (in the early 1900s). Henry Fayol principle of management states that employees should be paid fair wages for the work that they carry out. Any organization that underpays its workers will struggle to motivate and keep quality workers. Positives of remuneration of personnel principle of management: Supports achievement of organizational goals, Employees get motivated, Employee turnover is decreased, Quality employees are more motivated to work, Better relationship between employees and management, Increases the satisfaction of employees, and Raises the employee's living standards (Ismail, 2020).

H0.3: There is no significant impact of CMS Accounting module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.7 revealed that Accounting management module was positive and significant (β_3= 0.242; p< 0.05). Therefore, the null hypothesis was rejected and the study concludes that accounting management module is positive and exercise significant impact on Cooperative productivity and efficiency. This implies that there was up to 0.242 units increase in Cooperative productivity and efficiency for each unity increase in accounting management module holding all other independent variables constant.

These findings are consistent with the research of (Nworie's Lab, G. O., 2023) which indicated that Computerised Accounting System plays a crucial role in providing vital information for planning, organizing, directing, leading, and controlling the activities of an organization, thereby enabling administrators to make better strategic decisions. With its integrated set of physical and human elements, it promotes worker efficiency and enhances accuracy across the organization, thereby determining the effectiveness of the organization (Okafor, M. U., 2017).(Al-Dalaien, B. & Dalayeen, O, 2018)showed that the improved financial reporting standards brought significant changes in the way enterprises operates and manage their information. A typical 21st century commercial enterprise operates in a complex and competitive environment characterized by these changing conditions and highly unpredictable economic climate. Information and Communication Technology (ICT) is at the centre of this global change curve. SMEs though small, cannot ignore Information Systems because they play a critical role in the success of their organizations (Al-Dalaien & Dalayeen, 2018).

H1.2: There is significant impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.7 revealed that CMS Human resource management module was positive and significant (β_4= 0.016; p< 0.05). Therefore, the alternative hypothesis was accepted and the study concludes that CMS Human resource management module is positive and exercise significant impact on to productivity and efficiency of cooperatives in Rwanda. This implies that there was up to 0.016 units increase in Cooperative productivity and efficiency for each unity increase in CMS Human resource management module holding all other independent variables constant.

These findings are consistent with the research of (Salodkar, S. N. et al., 2020) that indicated that the relationship between Human Resource Management (HRM) and productivity. HRM includes incentive pay (individual and group) as well as many non-pay aspects of the employment relationship such as matching (hiring and firing) and work organization (e.g. teams, autonomy). The research places HRM more generally within the literature on management practices and productivity. The research start with some facts on levels and trends of both HRM and productivity and the main economic theories of HRM (Salodkaret al., 2020).

For (Oduro, R., Enyan, E. K., Acquah, A. A., & Quarm, R. S. , 2022) additional vital HR strategy to improve employees' productivity at work is keeping employees happy. Happy and satisfied employees are an excellent asset to any organization. Happy and satisfied workers will be committed to their work (Oduro et al. 2022).

H0.4: There is no significant impact of CMS Requisitioning module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.7 revealed that CMS Requisitioning management module was positive and significant (β_5 = 0.020; p< 0.05). Therefore, the null hypothesis was rejected and the study concluded that CMS Requisitioning management module is positive and exercise significant impact on productivity and efficiency of cooperatives in Rwanda. This implies that there was up to 0.020 units increase in Cooperative productivity and efficiency for each unity increase in CMS Membership management module holding all other independent variables constant. These findings are consistent with the research of (Adedeji, A., 2021) which showed that computerized requisitioning has the following advantages: Increased transparency, Mobile business processes, Efficient workflows, Improved purchasing culture, Proxy functions, and Short implementation timeframe. Easy Request is the ideal solution, not just for small to mid-sized companies. It can be implemented quickly and unites the purchase requisition with the solicitation of quotations and the orders. As a complete package and modular system – everything from a

single source – it is a genuine provider of efficiency and transparency (Adedeji, 2021).

H1.3: There is significant impact of Credit management module on productivity and efficiency of cooperatives in Rwanda.

The regression results presented in table 4.28 revealed that CMS Credit management module was positive and significant (β_6= 0.206; p< 0.05). Therefore, the alternative hypothesis was accepted and the study concluded that CMS Credit management module is positive and exercise significant impact on productivity and efficiency of cooperatives in Rwanda. This implies that there was up to 0.206 units increase in Cooperative productivity and efficiency for each unity increase in CMS Membership management module holding all other independent variables constant.

These findings are consistent with the research of Thuan et al. (2022) that indicated the following main activities of a credit management service namely: Credit risk prevention: management of customers default risk; Acceleration of receipts: management of cash recovery and litigation; Identification and treatment of non-recoverable invoices: dispute management; Depreciation of receivables: management of provisions for doubtful debts; Depending on the organization, related activities may also be under the responsibility of the credit manager: customer accounting, billing, management of bank guarantees (Thuan et al., 2022).

Table 4.7: Model coefficients results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.068	.038		1.789	.000
	CMSMembMgtMod	.051	.019	.049	2.684	.001
	CMSPayMgtMod	.279	.212	.258	1.316	.006
	CMSAccMgtMod	.299	.258	.242	1.159	.031
	CMSHrMgtMod	.019	.009	.016	2.111	.002
	CMSRequisMgtMod	.021	.012	.020	1.750	.012
	CMSCreditMgtMod	.207	.159	.206	1.302	.041
a. Dependent Variable: CooProd_&Effi.						

Source: Field data (2022).

Model summary

The model summary outlines the results of R- squared, also called coefficient of determination, which is a statistical calculation that measures the degree of interrelation and dependence between two variables. The model determines how much a variable's behavior can explain the behavior of another variable. The decision rule states that R-squared < 0.3 indicates none or very weak effect size, R-squared value 0.3 < r < 0.5 indicates a weak or low effect size, R-squared value 0.5 < r < 0.7 indicates a moderate effect size, whereas R-squared value r > 0.7 indicates strong effect size. The results indicated by the table 4.8 showed that the coefficient of determination R-squared value for this study is 0.705 (r > 0.7) indicating strong effect size. It shows how that the model fits the data at strong extent. These results indicate that 70.5% of variance in dependent variable was explained by independent variables. For this study, these results indicate that 70.5% of change in Cooperative productivity and efficiency come from CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtMod, CMSRequisMgtMod, CMSCreditMgtMod. The remaining 29.5% come from other factors.

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Table 4.8: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.84[a]	.705	.621	.27890
a. Predictors: (Constant), CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtMod, CMSRequisMgtMod, CMSCreditMgtMod				
b. Dependent Variable: CooProd_&Effi				

Source: Field data (2022).

Analysis of Variance (ANOVA)

The Analysis of Variance (ANOVA) is a statistical technique that is used to test the model fitness. The decision rule states that the model fit to predict variables if p- value <0.05; F being greater than F critical. The result presented in table 4.30 indicate that $F(8,106) = 7.0 > F_{critical} = 2.03$, $p<0.05$. Based on these statistical findings, the model is fit to predict study variables.

Table 4.9: Results of Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.840	8	.105	7.0	.000[b]
	Residual	1.590	106	.015		
	Total	2.430	114			
a. Dependent Variable: CooProd_&Effi						
b. Predictors: (Constant), CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtMod, CMSRequisMgtMod, CMSCreditMgtMod						

Source: Field data (2022).

Summary of hypotheses

Table 4.10: The summary of hypotheses

Hypothesis	**Conclusion**	**p-value**	**R^2**
H0.1: Cooperative managers do not appreciate the design and functionality of Cooperative Management System (CMS).	Rejected	($\bar{x}$= 3.8; σ = .270)	.705
H0.2: There is no significant impact of CMS Membership management module on productivity and efficiency of cooperatives in Rwanda.	Rejected	. 001	
H1.1: There is significant impact of CMS Payments management module on productivity and efficiency of cooperatives in Rwanda.	Accepted	. 006	
H0.3: There is no significant impact of CMS Accounting module on productivity and efficiency of cooperatives in Rwanda.	Rejected	. 031	
H1.2: There is significant impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda.	Accepted	. 002	

H0.4: There is no significant impact of CMS Requisitioning module on productivity and efficiency of cooperatives in Rwanda.	Rejected	.012	
H1.3: There is significant impact of Credit management module on productivity and efficiency of cooperatives in Rwanda.	Accepted	.041	

Source: Field data (2022).

CHALLENGES OF COOPERATIVE MANAGEMENT SYSTEM (CMS) AND SOLUTIONS

The main CMS challenges outline by the respondents are the following: The challenges are the following: CMS is not free. It requires additional contribution of members to cover the cost of its installation and maintenance ($\bar{x}$= 5.0; σ =.000); CMS requires the cooperatives to have among members those with advanced education level yet there are pure rural cooperatives where none have attended secondary school ($\bar{x}$= 4.3; σ =.080); CMS has issue of confidentiality of the data: the data of the cooperatives are managed by the government which hosts the CMS system ($\bar{x}$= 5.0; σ =.000); CMS use requires internet which incurs additional operational cost ($\bar{x}$= 4.1; σ =.351); Most of cooperatives managers prefer the ordinal routine of cooperative management due to low level of understanding and flexibility to change their routine services for adopting CMS ($\bar{x}$= 5.0; σ =.000).

Corresponding solutions proposed by the respondents are the following: Support of the RCA on installation cost and the cooperatives should cover maintenance costs($\bar{x}$= 4.8; σ =.070); More training on even members with good primary education on the use of CMS ($\bar{x}$= 4.3; σ =.380); Confederations should play important role in the management of CMS and the role of the government should be reduced with the time ($\bar{x}$= 4.9; σ =.290); The government should reduce the cost of internet to be affordable for all including cooperatives using CMS system($\bar{x}$= 4.7; σ =.151); More capacity building is required for cooperative managers to open their mind on the use of ICT foe the development. Also the experience of successful cooperatives in the use of CMS should be shared among cooperatives ($\bar{x}$= 4.6; σ =.400).

CONCLUSION

This research analyzed “Project design and implementation of cooperative management system (CMS) software and its impact on the efficiency and productivity of cooperatives in Rwanda” and it was conducted on 146 cooperatives using Cooperative Management System (CMS) across 19 districts of 4 Provinces of Rwanda (Eastern, Western, Northern, and Southern). The research assessed the appreciation of cooperative managers on the design and functionality of CMS and its impact on efficiency and productivity of cooperatives. Independent variables were six main modules of CMS namely Membership management, Payment module, Accounting module, Human resource module, Requisitioning module, and Credit module while dependent variable was Productivity and Efficiency of cooperative. The research was correlational design. The study used a sample of 750 respondents including 730 cooperative members from a total population of 61,320 members of 146 cooperatives using Cooperative Management System (CMS) across 19 districts of 4 Provinces of Rwanda (Western, Northern Eastern and Southern) plus 19 District Cooperatives Officers and 1Director of Cooperatives Promotion and Capacity Building Unit in Rwanda Cooperative Agency (RCA). A questionnaire designed in form of five levels Likert scale was used and data was collected and analysed through KoBo Toolbox and SPSS. For $H_0$1: Cooperative managers do not appreciate the design and functionality of Cooperative Management System (CMS), the results of descriptive statistics on overall appreciation of CMS by cooperatives managers indicated that the level of overall appreciation of CMS by cooperative managers is “Good” ($\bar{x}$= 3.8; σ = .270). For $H_0$2: There is no significant impact of CMS Membership management module on productivity and efficiency of cooperatives

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in Rwanda, The regression results presented in table 4.7 revealed that CMS Payments management module was positive and significant (β_2= 0.258; p< 0.05). For H0.3: There is no significant impact of CMS Accounting module on productivity and efficiency of cooperatives in Rwanda, The regression results presented in table 4.7 revealed that Accounting management module was positive and significant (β_3= 0.242; p< 0.05). For H1.2: There is significant impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda, H1.2: There is significant impact of CMS Human resource management module on productivity and efficiency of cooperatives in Rwanda. For H0.4: There is no significant impact of CMS Requisitioning module on productivity and efficiency of cooperatives in Rwanda, The regression results presented in table 4.7 revealed that CMS Requisitioning management module was positive and significant (β_5= 0.020; p< 0.05). For H1.3: There is significant impact of Credit management module on productivity and efficiency of cooperatives in Rwanda, The regression results presented in table 4.28 revealed that CMS Credit management module was positive and significant (β_6= 0.206; p< 0.05). The results indicated by the table 4.8 showed that the coefficient of determination R-squared value for this study is 0.705 (r > 0.7) indicating strong effect size. It shows how that the model fits the data at strong extent. These results indicate that 70.5% of variance in dependent variable was explained by independent variables. For this study, these results indicate that 70.5% of change in Cooperative productivity and efficiency come from CMSMembMgtMod, CMSPayMgtMod, CMSAccMgtMod, CMSHrMgtMod, CMSRequisMgtMod, CMSCreditMgtMod. The remaining 29.5% come from other factors.

RECOMMENDATIONS

To RCA

The research found that RCA is less involved in the adoption and use of CMS. However, there is an issue of security of data since CMS is hosted by a partnership between Government and Private sector through the Ministry of ICT. The research recommends the RCA the following:

- To take the responsibility of hosting the CMS in order to ensure sustainability and resilience of the system. This because the RCA was established to promote cooperatives in Rwanda.
- The adoption of CMS seems an initiative took by the private sector under the support of the government; but there was no involvement of cooperative members in the design of the project. The risk is high that cooperatives may pay affiliation fee to CMS but use it less due to poor conviction about its importance. RCA should participate in the training and motivating the use of the system through issuing the incentives to adopt it by several means including rewarding the best users cooperatives or covering a portion of fee in form of direct support to cooperatives.
- To ensure the maintenance of CMS by RCA for alleviating this burden to the cooperatives members.
- To support small cooperatives with good intention to adopt the system but having limited financial means by covering at least 50% of the adoption costs.
- To advocate to the government to reduce the cost of internet to be affordable for all including cooperatives using CMS system.

To Cooperatives

- To plan a big role in motivating other cooperatives adoption CMS through experience sharing. In fact, the government of Rwanda is committed to zero paper and zero trip for government services in 2024. The private sector including cooperatives should therefore align to this government plan and adopt ICT for smooth management of their business.

- To provide more training on even members with good primary education on the use of CMS
- More capacity building is required for cooperative managers to open their mind on the use of ICT foe the development.
- To share experience of successful cooperatives in the use of CMS to new and reluctant cooperatives.

Suggestions for further research

This research was qualitative as it collected the perceptions of the cooperatives managers and the stakeholders on the use of CMS for their productivity and efficiency. Further studies should use a quantitative approach and demonstrate quantitatively the contribution of CMS on productivity and efficiency of the cooperatives. The topic should be "Quantitative analysis of the impact of CMS on productivity and efficiency of cooperatives in Rwanda".

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