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## **USING AGILE PRACTICE UNDER THE CD-ERP MODEL: A HYBRID APPROACH**

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## **WYKORZYSTANIE ZWINNYCH PRAKTYK W MODELU CD-ERP: PODEJŚCIE HYBRYDOWE**

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**Abstract:** This paper examines the applicability of agile practice in the Collaboratively-Developed Enterprise Resource Planning (CD-ERP) Model. This model has been proposed as a solution to develop Information Systems (ISs) for public universities in Libyan Higher Education (LHE) following the community-source paradigm and based on ERP. The study took place between 2016 and 2020. The purpose of the article is to discuss the possible impact and success of implementing agile practice in such an environment, while a hybrid approach involving agile practice and a predictive method was introduced. The risks and challenges associated with adopting the CD-ERP model are discussed using a SWOT analysis. Finally, the lessons learnt, recommendations, and directions for future work are presented.

**Keywords:** community source, agile, CD-ERP model, SWOT analysis, strategic system planning, information system.

**Streszczenie:** W artykule przeanalizowano możliwość zastosowania zwinnej praktyki (*agile practice*) w modelu wspólnie opracowanego systemu dla planowania zasobów przedsiębiorstwa (CD-ERP). Model ten został zaproponowany jako rozwiązanie służące rozwojowi systemów informatycznych (IS) dla publicznych uczelni w Libii (LHE) zgodnie z paradygmatem społecznościowym i opartym na ERP. Badanie odbyło się w latach 2016-2020. W artykule omówiono możliwy wpływ i sukces wdrożenia zwinnej praktyki w takim środowisku. Opiszano podejście hybrydowe obejmujące zwinną praktykę i metodę predykcijną. Ryzyko i wyzwania związane z przyjęciem modelu CD-ERP omówiono, analizując mocne strony, słabe strony, szanse i zagrożenia (SWOT). Na koniec przedstawiono wyciągnięte wnioski, zalecenia i kierunki przyszłych prac.

**Słowa kluczowe:** *community-source* (wspólnie opracowany system), *agile* (praktyki zwinne), model CD-ERP, SWOT, strategiczne planowanie systemu, system informacyjny.

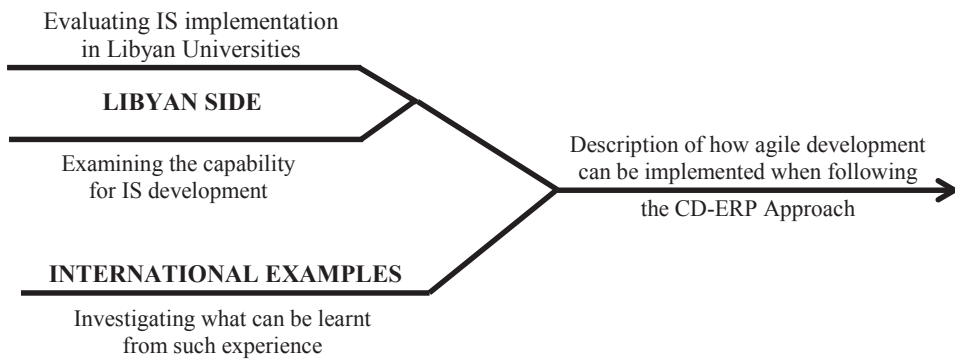
## 1. Introduction

As a developing country, Libya is struggling to invest more in information and communication technology (ICT) in several economic sectors. Higher education (HE) is one vital sector that needs extensive improvements in the level of information technology (IT). Using IT effectively in HE is a requirement for enhancing its performance. The issue of information system (IS) development is a crucial part of ICT (Raja and Nagasubramani, 2018; Stosic, 2015). Like other HE institutes all over the world, Libyan universities have been working on developing their own ISs or adopting commercial solutions. Both models have shown negative results to some degree (Liu, Sean, and Tu, 2015; Liu and Qiang, 2011). The research team has, therefore, investigated the applicability of a new approach, abbreviated to CD-ERP, in Libyan higher education (LHE). CD-ERP is an alternative to and intermediate between two well-known models, namely closed and open-source systems. Generally, this model is based on two principles, ERP packages and community-sourcing. In this research, the latter is referred to as the collaborative development approach. In this context, the authors propose the form of an open-source project that is governed by a consortium of educational institutions (Wheeler and Hilton, 2012). Besides its potential benefits, ERP is included to avoid rebuilding systems from the very beginning. Similar projects are found in many countries, including some EU countries and the USA (Ignjatovic and Jovanovic, 2013; Paulsen, 2002; Desnos, 2001; Cuni, 2014; Czerniak, 2010; Feasibility study, 2012; Hubner et al., 2008).

This paper discusses a hybrid approach to development under the CD-ERP model based on agile practice. Factors that could influence the development process in a community-source environment were also considered, including the core members and how they are selected, the methodology of system development using agile practice, and the participation of the committee for development partners. It is at present unclear what risks and challenges are inherent in adopting the CD-ERP model, especially when agile practice is involved. Thus to provide a strategic view of the CD-ERP model, a SWOT analysis was conducted.

## 2. Research methodology

As illustrated in Figure 1, the authors examined: firstly the Libyan side, in terms of IS performance, the capability to develop ISs, and other aspects of LHE at university level. The results of the fieldwork in Libya can be found in (Almigheerbi, Ramsey, and Lamek, 2019) (Almigheerbi et al., 2020), while other publications on the topic of the CD-ERP model can be found in (Almigheerbi, Ramsey and Lamek, 2020a, 2020b, 2020c) and. Secondly the international side was studied in terms of how such ISs have been implemented and what can be learnt from these experiences. As a result, the outcome of this paper is the proposal of a hybrid approach to development under the CD-ERP model, and a set of recommendations regarding how agile practice can be implemented in the Libyan context.



**Fig. 1.** The research methodology

Based on the above, the authors chose multiple case studies where the subjects were<sup>1</sup>: University of Tripoli (UOT); Misurata University (MU); and Sirte University (SU). These are all Libyan public universities of different sizes and histories, as reflected by the data collected from these cases. A series of interviews with employees of these universities was conducted. The authors limited the study to persons who are actively involved in the process of implementing new ISs. Consequently, the target population is composed of experts in the Centre/Department/Division for IT related issues in each university. The output of these interviews comprises narrative observations based on the participants' knowledge and experiences related to the subject of this study. The authors analysed these observations by interpreting the contextual features of the participants' experiences, taking into consideration the observations from a literature review and international experiences.

<sup>1</sup> At the beginning of this research, three universities were chosen as case studies based on their size and date of founding. After conducting the initial study, in which UOT acted as one case, it was possible to decide whether or not to include more case studies of Libyan universities.

### 3. Findings, analysis and discussion

In this section, the authors give a brief discussion of the main issue of this paper, namely what is the appropriate approach to IS development using CD-ERP in LHE. The authors used Libyan universities as a model, conducting surveys on three public universities in Libya (UOT, MU, and SU). Although only three Libyan universities were studied directly in this research, information about the ISs implemented in other universities was obtained indirectly. IS researchers have long argued that the architecture of a system plays a pivotal role in coordinating development work (Herbsleb and Grinte, 1999). The architecture proposed for CD-ERP is based on Conway’s law, which states that the design of IS reflects how an organization communicates in everyday business. In this context, some elements are discussed in this section, such as the selection of the core members and associated tasks, and the SDLC (System Development Life Cycle).

#### 3.1. Selection of the core members and associated tasks

The selection of the core members is summarized in Figure 2. Since Libya consists of six regions, the authors selected the leading university in each region based on size and year of establishment. The western region is the only one represented by two universities (UOT and MU), partially since it is the most populated region in Libya. UOT is also considered to be the leading university in Libya and has contributed to the establishment of other universities. The university is located in the capital city, Tripoli, which is the most developed city in Libya and where all of the ICT companies operate. Moreover, the findings indicated that UOT showed the highest level of IS implementation (both online and offline) among the universities studied. Hence, UOT was chosen as the main headquarters of the system. Later, two regional headquarters were added,

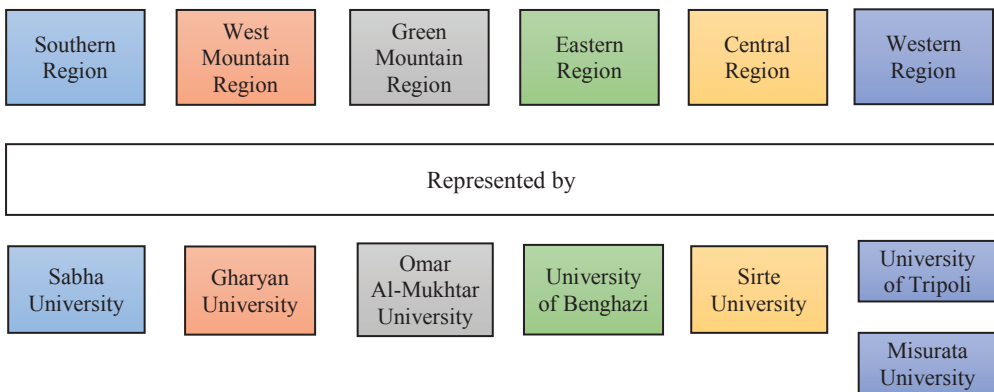


Fig. 2. The core members of the consortium

Benghazi University and Sabha University<sup>2</sup>. Decentralization is desirable since Libya is the fourth largest country in Africa and the 16<sup>th</sup> largest country in the world, thus it is impractical to have only one headquarters.

**Table 1.** Example of dividing modules between core members

IS Module	Application Layer	Database	Web content
Educational Activities (Led by UOT)			
Student information system (SIS)	SU	Gharyan University	Sabha University
Enrolment of new students			
Learning management systems (LMS)			
E-learning system			
Library system			
Laboratories system			
Virtual libraries and simulation systems			
Postgraduate IS			
Research Activities (Led by University of Benghazi)			
Research IS			
Digital archive			
System for refereed journals			
System for research laboratories			
Libraries IS			
Publishing IS			
Other Activities (Led by Sabha University)			
Monthly-grant IS			
Finance & Accounting IS			
HR IS			
Content management system (CMS)			
Sales IS			
Warehouse IS			
Lands and real-estate IS			

During the research it was also noted that assigning entire modules to individual core members to be developed separately is expected to have the drawback that different locations will become over-specialized in particular components. Over time this would build up knowledge silos, often leaving the team with new work that can

<sup>2</sup> The choice of the University of Benghazi and Sabha University, along with UOT, is based on the three historical provinces of Libya. All recent Libyan governments have used this administrative division, although there are now more provinces in Libya.

only be carried out by one or two people. The solution proposed under the CD-ERP model is to assign the modules to be developed to various members in such a way that the teams are split horizontally (e.g. one university is responsible for the presentation/user-interface, another for the database, and another for web-based services). The division of the modules should be roughly equal among the core members to guarantee that none of the universities becomes over specialized in particular modules. The classification of these modules is again based on the model of business activities in HE institutes presented by (Zornada and Velkavrh, 2005), which was used throughout this research. In each class the development process should be led by one major university (UOT, University of Benghazi or Sabha University). This will simplify coordination between the universities involved in developing a particular module, as well as with the vendors of the ERP on which the system is based. These three universities were also projected to be the headquarters of the system.

To clarify this the following example was discussed as illustrated in Table 1. The development of the modules listed under educational activities (including the student information system – SIS) is led by UOT. The first row shows that the SIS module is to be developed by three members (the application/user interface by SU, the database by Gharyan University, and the web content by Sabha University). UOT is responsible for guiding and controlling the development of this module, as well as the coordination between these three universities. Similarly, several universities collaborate in the development of other modules, while control of the development process in each case is conducted by one of the three leading universities in Libya.

### 3.2. The System Development Life Cycle (SDLC) under the CD-ERP model

As mentioned above, the CD-ERP model describes a distributed environment that, by its nature is not suited to agility, and in addition a traditional SDLC is impractical. Thus the authors proposed a hybrid model that is based on the bimodal principle in which a traditional (predictive) model and an adaptive model are combined. As

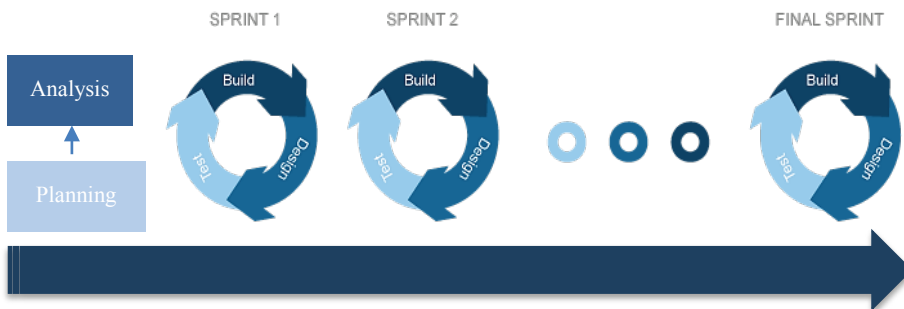


Fig. 3. Proposed SDLC under the CD-ERP model

illustrated in Figure 3, the planning and analysis phases (using a predictive model) are first carried out for each module. Then each module goes through several sprints to deliver the final product.

### 3.3. Participation of the Committee for Development Partners

Cooperation between universities and industry has existed for a long time in various forms such as joint ventures, networks, consortia and alliances, that may vary based on the engagement of the participants (Ankrah and Altabbaa, 2015). Within the framework of this research it was not practical to discuss the different typologies or taxonomies of academic-industrial relationships as described in the literature, but rather to briefly discuss the participation of IT firms (members of the Committee for Development Partners) in the proposed model, with an emphasis on IS development. Since academic-industrial collaboration occurs in various forms with benefits to both sides, the authors only discussed to what level external companies should be involved in the CD-ERP model. The following list is a summary of examples of the involvement of companies in terms of IS development<sup>3</sup>.

- Participating in the funding of consortium projects.
- Internships for fresh graduates, who will work for universities, and training programs for current employees.
- Exchange programs (e.g. secondment of programmers, analysts, developers).
- Use of company facilities (e.g. laboratories, databases, servers).
- Cooperative research projects (in which universities and companies could establish a joint research project to address some issues that need to be solved, or enhance features of the system).
- Consultancy and advisory boards in the form of general assistance units (including units that enable the transfer of technology between both sides).
- Technological brokerage companies which function as brokers between universities and industry.
- Supporting patenting and licensing agreements (licensing of intellectual property rights).

## 4. A strategic view of the CD-ERP model using SWOT

Among the techniques applied for strategic planning, SWOT is a very commonly used tool. SWOT is a qualitative and descriptive assessment of strengths, weaknesses, opportunities, and threats (Omer, 2019) – hence the acronym. It emerged in the literature in the 1960s, and some scholars credited this concept to Harvard Business School, while other scholars attributed it to Stanford University (Gurel and Tat, 2017). Its general idea is to use an organization's knowledge about its internal and external environments to formulate its strategy (Sammut-Bonnici and Galea, 2015).

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<sup>3</sup> This list is based on the outline presented in (Ankrah and Altabbaa, 2015).

Table 2. SWOT analysis for the CD-ERP model

SWOT ANALYSIS	
STRENGTHS	<ul style="list-style-type: none"> <li>Libyan universities are organizations that share common characteristics with compatible business processes and, in particular, are geographically clustered.</li> <li>A central organization (the Libyan Ministry of Education) delivers joint services to multiple IT sub-departments (of Libyan public universities)</li> <li>Cooperation in IT has already been established between Libyan public universities.</li> <li>HE is a sector based on knowledge sharing and thus collaborative development is a perfect fit for HE.</li> <li>A pool of resources available at national level.</li> <li>Highly qualified, talented and dedicated faculty, as well as knowledgeable staff members, who are specialized in the field of ISs to lead the development process.</li> <li>Freshly qualified graduates in IS development.</li> <li>Well-known providers of ERP/Cloud Computing (CC) services.</li> <li>The availability of a modern learning environment in CC.</li> </ul>
WEAKNESSES	<ul style="list-style-type: none"> <li>Issues of communication, coordination, control, development, and maintenance in a geographically dispersed team.</li> <li>The issue of project management.</li> <li>Security concerns regarding the ERP model in general.</li> <li>The need for ERP customization.</li> <li>Challenges to adopting CC, or multi-tenancy architecture, such as security, regulations and scalability.</li> <li>Ensuring the balanced involvement of all the consortium members in decision-making.</li> <li>Diverse requirements of various partners.</li> <li>The issue of governance and the ownership of code.</li> <li>Organizations of different sizes working together.</li> <li>Changing goals or vision among the members of a community can lower the level of cooperation, or in some cases even terminate a project.</li> <li>Individual universities might be specialized in particular modules. These types of expertise may not complement each other.</li> </ul>
OPPORTUNITIES	<ul style="list-style-type: none"> <li>Huge opportunity to team up with other universities.</li> <li>Central repository: all the business activities of universities (educational, research and other activities) to be supported by one integrated system.</li> <li>Working jointly is expected to achieve greater revenue, as well as enable higher productivity and quality, at a lower cost.</li> <li>Developing open-source applications collaboratively can give results that meet the needs of all the participating institutions.</li> <li>Access to leading-edge infrastructure and the ability to gather data from all the HE institutes at national level under the Ministry of Education.</li> <li>By adopting ERP, there is no need to build a system from scratch.</li> <li>Tremendous opportunity to work with well-known international projects that use a similar approach and learn from their experiences.</li> <li>A door towards initiating other joint projects between universities, not just IS development.</li> </ul>
OBSTACLES	<ul style="list-style-type: none"> <li>Decreasing government funding and increasing expectations from stakeholders.</li> <li>The level of technology in Libya is low.</li> <li>National rules and regulations related to adopting the CD-ERP Model.</li> <li>Loss of expertise through retirement and employee turnover, as well as not being able to attract experts in IS development.</li> <li>Bureaucracy in LHE.</li> <li>Current instability in Libya.</li> <li>Commitments of the service providers.</li> </ul>



In this section the authors applied a SWOT analysis to describe the strengths and weaknesses of the CD-ERP approach in developing ISs for higher education in Libya. Next a list of recommendations, actions and comments was provided, which can be converted into a strategy that adopts the CD-ERP approach. It should be noted that SWOT uses the term ‘threats’ in describing the external factors that negatively affect a business strategy, such as possible competitors. At the same time, community-source models, such as CD-ERP, form an environment where each partner should view other partners as non-competing, in order to share the costs, risks, and potential rewards. Hence the authors used the term ‘obstacles’ instead of ‘threats’ to discuss the external factors that might negatively affect the effectiveness of the CD-ERP model when adopted in the Libyan context.

This analysis was compiled from the case study responses, relevant literature and international experiences. In addition, some factors were excluded from this analysis since they are common to any situation in which an organization experiences change (e.g. resistance to change, or a lack of commitment from top management). The authors chose to conduct this analysis at the end of the project, since the application of SWOT needs a rich information and knowledge base to succeed. After constructing the SWOT table, the following questions arose: How should these strengths be used to take advantage of the opportunities? How should these strengths be used to overcome the obstacles that might threaten the implementation of the CD-ERP approach? How can one counteract the weaknesses in CD-ERP? The following list presents the comments and recommendations as answers to these questions that can be converted into a real strategy in the future.

- Under the CD-ERP approach, the Libyan Ministry of Education acts as a reliable central organization and guarantor of the central repository that delivers joint services to multiple IT sub-departments (of LHE institutes). Since public LHE institutes are wholly funded by the government, the introduction of such an approach is made easier by forcing LHE institutes to follow it. This point may be viewed as a drawback, since the institutes do not have the final decision. It can, however, be interpreted as an advantage in overcoming some issues, such as resistance to change.
- One of the promising opportunities is the development of cooperation between universities. In particular, the fieldwork in Libya has shown a low level of capacity for individual institutes working separately to develop ISs, but that cooperation in IT has already been established between Libyan public universities.
- As an extension to the previous point, universities usually experience a loss of expertise through retirement and not being able to attract new experts in IS development. This issue may be solved by a fundamental aspect of the CD-ERP approach, namely, IS development is conducted by the consortium as a whole. Indeed, when a new team is hired in one institute, it can be trained in another location by another member of the consortium. Specifically, these institutes together have talented, dedicated, and knowledgeable staff members who are

specialized in ISs and can lead the development process, together with a supply of freshly qualified graduates in IS development.

- One of the obstacles is decreasing government funding and increasing expectations from stakeholders. By adopting the CD-ERP model, a consortium of Libyan universities is projected to create a pool of nationally available resources that should counteract any fall in government subsidies. Another opportunity lies in access to leading-edge infrastructure and the ability to gather data from all HE institutes at national level under the Ministry of Education. This should also overcome the issue of the low level of technology in Libya.
- Another weakness in the CD-ERP approach is the need to customize the ERP system, which could result in difficulties when ERP providers update their system. Several solutions to this problem are available under the CD-ERP model. For example, the CD-ERP approach is built using multi-tenancy software architecture, so customization can be carried out during run-time. Thus the original code of the ERP system does not have to be changed. Additionally, it is recommended to customize only the critical components of the system.
- The fair involvement of all the consortium members in decision-making is another issue, especially when organizations are of different sizes. The consortium consists of two main bodies, the Consortium Council and the Board of Executive Directors, along with other committees. Such a structure ensures that all members have the right to be involved in the decision-making process. The consortium is non-profit, the fees collected are used to cover the costs of system development. The level of fees is based on the size of a member, so that even small institutes can join the consortium.
- Developing open-source applications collaboratively can give results that meet the needs of all the participating institutions. The diverse requirements of various partners are handled by the set of core members forming the Board of Executive Directors, while the precise needs of members are addressed by the Consortium Council. This structure should ensure that the development process is not slowed down by the diverse requirements of the members. Essentially, Libyan universities are organizations that share common characteristics with compatible business processes and, in particular, are geographically clustered, as shown by the fieldwork in Libya.
- The issue of governance and the ownership of code is another concern. In the CD-ERP approach, all members have the rights to open-source ERP-based integrated systems. The source code is available on-demand to institutes participating in the project with no limit as to the number of internal end-users or installations.
- The active commitment of service providers, such as ERP vendors and CC providers, is crucial, therefore the choice of service providers should be considered carefully, especially taking into account that firms may become cease trading.

- Some issues that commonly occur in a distributed environment, such as a lack of communication, control or coordination in project management could be linked to the problem of a member becoming over-specialized in particular modules. Such issues could be solved by ensuring that specialization in specific modules is spread horizontally. Hence modules are split horizontally between universities (one university manages the presentation/user-interface, another manages the database, while another one manages the web-based services). Such a structure should minimize the problems that typically occur in a distributed environment (as described above). In fact, this point leads to a very interesting matter to be investigated in the future.
- There exists a tremendous opportunity to work with well-known international projects that use a similar approach and learn from their experiences, especially since some projects, such as Sakai and Quali, have already been implemented in other universities than those in which they were developed.

## 5. Conclusion

The authors concluded with a brief discussion of the main subject of this paper. ISs developed using community-source have been successfully implemented, as shown by international experiences. Accordingly, the authors proposed an approach called the CD-ERP model, based on two main principles, namely ERP packages and a collaborative development approach. With regard to ERP, Libyan universities would avoid building their systems from scratch by adopting ERP-based solutions. However, traditional methodologies of system development or predictive methods, such as Waterfall, are difficult to apply in community-source projects due to their size and complexity. Similarly, adaptive methodologies such as agile, are not usually considered. Therefore the authors propose a hybrid methodology of system development to suit the unique characteristics of the community-source environment. Under this new methodology, the planning and analysis phases are first carried out using a predictive method for each module of the project. Following this, each module goes through several sprints to deliver the final product, as in agile practice. The article also discussed the selection of the core members in the consortium, which affects the development process. The core members and their selection play a vital role in the success of the development process. The purpose of having a set of core members is to avoid delays in the development process that are likely when a large number of members with a variety of goals are involved in all of the decision processes. This study considered the risks, challenges, benefits and opportunities associated with following a CD-ERP approach, in particular when following agile practice. This was conducted using a SWOT analysis, while other tools for strategic analysis are also available, such as PESTLE (Political, Economic, Sociological, Technological, Legal and Environmental). The authors recommend that such an approach should be adopted to make a systematic and thorough evaluation of the CD-ERP model in the future.

## References

- Almajalid, R. M. (2017). *A Survey on the Adoption of Cloud Computing in Education Sector*; Cornell University Library. Retrieved November 11, 2018 from <https://arxiv.org/abs/1706.01136>
- Almigheerbi, T. S., Ramsey, D., and Lamek, A. (2019). *Evaluation of the performance of information systems implemented at the University of Tripoli, Libya*. Austria: Vienna.
- Almigheerbi, T. S., Ramsey, D., and Lamek, A. (2020a). A collaboratively-developed enterprise resource planning (CD-ERP) Approach in Libyan higher education. *International Journal of Information and Education Technology*, 10(4), 284-298.
- Almigheerbi, T. S., Ramsey, D., and Lamek, A. (2020b). An empirical analysis of critical success factors for CD-ERP model. *Journal of Computers*, 15(2), 37-47.
- Almigheerbi, T. S., Ramsey, D., and Lamek, A. (2020c). Approach to the methodological assessment of the performance of information systems at Libyan Universities (Based on multiple case studies). *International Journal of e-Education, e-Business, e-Management and e-Learning*, 283-293.
- Almigheerbi, T. S., Ramsey, D., and Lamek, A. (2020d). Information management in a collaboratively-developed approach to enterprise resource planning – a higher education perspective. *Information Journal*, 11(3).
- Ankrah, S., and Altabbaa, O. (2015). Universities – industry collaboration: A systematic review. *Scandinavian Journal of Management*, 31(3), 387-408.
- Cuni, N., 2014. Scientific outputs: integration and unification of catalan CRIS information systems. *Procedia Computer Science*, 33, 278-283.
- Czerniak, M., 2010. *Student management information system for Polish Universities at its tenth anniversary* (The 16th International Conference of European University Information Systems). Warsaw.
- Desnós, J.-F. (2001). *A national data warehouse project for French universities* (The 7th International Conference of European University Information Systems). Berlin.
- Feasibility-study. (2012). *Modernisation of student information systems*, by University of Tampere. Retrieved December 1, 2018 from <https://blogs.helsinki.fi/otm-esiselvitys/files/2012/11/OTM-final-report-en.pdf>
- Gurel, E., and Tat, M. (2017). SWOT analysis: a theoretical review. *The Journal of International Social Research*, 10(51), 994-1006.
- Herbsleb, J., and Grinte, R. (1999). Architectures, coordination, and distance: conway's law and beyond. *IEEE Software*, 1(1), 63-70.
- Hubner, U. et al. (2008). *HISinOne – development and early adoption partnerships* (The 14th congress Conference within the Framework of the European University Information Systems Organisation (EUNIS)). Denmark: Aarhus C.
- Ignjatovic, M., and Jovanovic, S. (2013). Implementing Sakai open academy environment – pros and cons. *International Journal of Emerging Technologies in Learning (iJET)*, 8(1), 64-68.
- Liu, M., and Qiang, T. (2011). *Community-based open source: the phenomenon and research opportunities* (The 13th International Conference on Enterprise Information Systems). China: Beijing.
- Liu, M., Sean, H., and Tu, Q. (2015). *Toward sustainable collaborative software development: a case in higher education* (Twenty-first Americas Conference on Information Systems). Puerto Rico.
- Mathew, S. (2012). Implementation of cloud computing in education – a revolution. *International Journal of Computer Theory and Engineering*, 4(3), 473-475.
- Omer, S. K. (2019). SWOT analysis implementation's significance on strategy planning Samsung mobile company as an example. *Journal of Process Management – New Technologies*, 7(1), 56-63.
- Paulsen, M. F. (2002). Online education systems in Scandinavian and Australian universities: a comparative study. *International Review of Research in Open and Distance Learning*, 3(2), 1-11.

- Raja, R., and Nagasubramani, P. C. (2018). *Impact of modern technology in education*. Tamil Nadu, India, Recent Trend of Teaching Methods in Education.
- Sammut-Bonnici, T., and Galea, D. (2015). SWOT Analysis. In C. Cooper (Ed.). *Wiley Encyclopedia of Management – Volume 12 Strategic Management*. Hoboken, New Jersey: John Wiley & Sons, 1-8.
- Stosic, L., 2015. The importance of educational technology in teaching. *International Journal of Cognitive Research in Science, Engineering and Education*, 3(1), 111-114.
- Wheeler, B., and Hilton, J. (2012). *The Marketecture of Community*, Educause review. Retrieved December 12, 2018 from <https://er.educause.edu/~media/files/article-downloads/erm1261.pdf>
- Zornada, L., and Velkavrh, T. (2005). *Implementing ERP systems in higher education institutions*. (The 27th International Conference on Information Technology Interfaces). Croatia: Cavtat.