Research Article

Transforming Medical Assistance Fund Application Management: A Business Process Reengineering Approach

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Abstract

The application process for the Medical Assistance Fund (MAF) to help patients receive medical interventions at public hospitals has been plagued with delays due to the increasing number of applications, inefficient management, and manual tasks. This study aims to redesign the current application process through Business Process Reengineering (BPR) and to evaluate the effectiveness of a new process to be carried out by the Medical Social Work Unit (MSWU). A new methodology, *B2Lean* which is based on a combination of the BPR and Lean Thinking was proposed to help identify the processes requiring improvement and to remove inefficient ones. A new online application system, the Patient Assistance Management System was proposed as an IT enabler for this BPR initiative. This study was based on a qualitative research methodology involving a case study in which interviews and observations were used to collect data. The sample study consisted of seven MSWU officers and several supporting staff selected from a government hospital. In the interviews, the '5W 1H' technique was used to elicit and analyze their feedback on issues relating to the existing processes. The findings of the analysis revealed that several manual tasks were inefficient, which had to be either removed or replaced, effectively helping to reduce the overall processing time by 52%. With the new and efficient processes, practitioners could certainly expedite patients' applications for medical assistance, thus helping them to receive prompt medical interventions. The B2Lean methodology could be used as a guideline for organizations seeking improvement in their current practices.

Keywords: business process reengineering, medical assistance fund, hybrid methodology, IT enabler, effectiveness.

INTRODUCTION

Over recent years, the number of patients seeking medical treatments has climbed steeply, entailing healthcare centers to have efficient delivery mechanisms (Li et al., 2020; Gianchandani, 2011). As such, a lack of effective mechanisms for clinical processes can have a negative impact on healthcare services, such as long waiting periods or massive queuing, ultimately causing dissatisfaction among patients (Gartner & Padman, 2016). Such problems occur at the Medical Social Work Unit (MSWU) where patients' medical applications are often delayed, which could be detrimental to patients with chronic and serious illnesses, such as stroke, diabetes, and cancer.

Arguably, the increasing number of referrals seeking medical assistance is mainly due to financial and psychological issues, such high cost of treatment and a lack of motivation and self-confidence (Meerten

et al., 2014; Edwards & Crisp, 2017). Since its inception, MSWU services have been provided by Malaysia's public hospitals to help meet the social needs of patients and their families. Hence, these social workers must have sound management skills to help them deal effectively with patients and their families' social, financial, and psychological needs (Wright et al., 2012).

Patients referred to hospitals will be evaluated based on their socio-economic status by the MSWU officers, entailing close scrutiny to ascertain the former's awareness and knowledge are sound prior to treatment with medical specialists. The same officers also help economically disadvantaged patients in seeking financial assistance. In view of the increasing cases of referrals being processed, MSWU personnel need to re-examine their current practices by focusing on technologies and techniques that could help improve their work efficiency; hence, lies the role played by the Business Process Reengineering (BPR) process.

BPR in healthcare refers to the systematic redesign of healthcare processes to improve quality of care, patient outcomes, and operational efficiency. Healthcare organizations often face challenges such as rising costs, inefficiencies, fragmented care delivery, and varying quality standards. BPR aims to address these challenges by fundamentally rethinking and redesigning processes to deliver better outcomes for patients and stakeholders.

Essentially, the business process is the main component of BPR, which can be changed or replaced to help organizations enhance their business practices by effectuating improvement in terms of the structural aspects of a task, its management, measurement system, values, and beliefs. Chen and Tsai (2008) and Bhavsar et al. (2019) both emphasize the importance of Business Process Modelling (BPM) in the context of BPR.

BPM is a crucial aspect of business process, involving the graphical representation of an organization's processes, which aims to analyze, improve, and automate business processes for enhanced efficiency and productivity (Kissflow, 2024; Scheruhn et al., 2015). The healthcare domain is increasingly adopting BPM techniques to streamline operations and enhance care delivery and in healthcare it is a crucial aspect of improving efficiency, quality, and patient outcomes.

This study focuses on efficiency, namely reducing the time spent processing an application. The importance of time management in BPR is highlighted in several studies. Eder and Franceschetti (2020) underscore the significance of time as a key resource in business processes. They also discuss the challenges and achievements in time management, including the need for process models to express temporal durations and constraints, and the use of proactive time management to avoid time failures. These studies collectively underscore the critical role of time BPR.

According to Akua (2014), effective time management is important to ensure activities are conducted with a greater emphasis on effectiveness rather than on efficiency. In principle, good time management could be defined based on how a person uses his or her time wisely to produce something productively, which may rely on a myriad of factors such as moral and financial support, technologies, or systems. He also asserts that managing time efficiently could lead to proper decisions, especially in situations with limited resources.

In this study, a new process model called the To-be Process, was developed to help MSWU officers to process patients' hospitalization and treatment applications more expeditiously. The effectiveness of this was measured in terms of the time taken to complete the whole application process in one of Malaysia's public hospitals. This study aims to redesign the current process of medical assistance application

management by identifying processes that can be improved or eliminated, thereby creating an efficient and systematic system.

LITERATURE REVIEW

Medical social work (MSW)

Medical social work (MSW) services are one of the social practices in the medical field that focus on addressing the social needs of patients seeking hospitalization and treatment and their families' concerns. As such, MSWU was established to assist patients seeking assistance for medical treatment and hospitalization. From the socio-cultural perspective, the services provided by MSWU are often compared to those of the Social Welfare Department (SWD) given to the poor and disabled.

In recent decades, the increasing competition in public healthcare has compelled many healthcare organizations to undergo major reforms to improve their efficiency by reducing waste and enhancing service delivery. For example, in the People's Republic of China (PRC), Lu and Su (2010) found that one of the worrying issues facing health services in the PRC is the so-called "three long-term and one short-term problems". Specifically, the term "three long-term" signifies an excessively long time in registration, seeing a doctor, and getting medical prescriptions. Comparatively, by contrast, the term "one short-term" means a medical consultation is too brief, lasting only three (3) to five (5) minutes.

Business Process Reengineering (BPR)

The sustainability of many business organizations hinges on their ability to adapt to evolving challenges, particularly amid increasing global or local competition. One approach frequently utilized for this purpose is Business Process Reengineering (BPR) (Fetais et al., 2022; Butt, 2020). As the dynamics of the business environment continue to shift, organizations are compelled to rethink and redesign their processes. BPR stands out as a management approach adopted by many to achieve significant improvements in performance and cost reduction (Bayomy et al., 2024).

The primary goal of such reengineering endeavors is to deliver services or products with the lowest possible cost, shortest turnaround time, and enhanced quality (Bayomy et al., 2021), thereby enhancing performance, flexibility, and profitability (Fetais et al., 2022). Moreover, BPR is widely recognized for its effectiveness in fostering organizational improvement opportunities (Hameed et al., 2021).

Research findings underscore the critical factors enabling successful BPR implementation within the Egyptian banking sector. These include management commitment, IT infrastructure, people management, change readiness, and a less formalized organizational structure (Hashem, 2019). Notably, there exists an interdependent relationship between IT and BPR, emphasizing the need for their integrated implementation (Fetais et al., 2022).

Additionally, Hameed et al. (2021) reveal that BPR dimensions such as top management commitment, organizational readiness for change, information technology capabilities, and people management significantly influence organizational performance. Furthermore, the presence of strategic thinking within the organization amplifies the impact of organizational structure and other aforementioned dimensions on performance.

Business Process Modeling (BPM)

In essence, while BPR focuses on strategic, transformative changes to business processes, BPM provides the methodological tools and techniques to analyze, design, and implement those changes effectively. BPM is the practice of creating graphical representations or models of business processes to understand, analyze, and optimize them. BPM often serves as the initial step in a BPR initiative. Before reengineering a process, it is crucial to understand its current state thoroughly.

BPM facilitates this by allowing stakeholders to document and analyze existing processes, identifying pain points and areas for improvement. During the design phase of BPR, BPM plays a critical role in developing new process designs. BPM tools and methodologies help stakeholders visualize and simulate alternative process designs, allowing them to evaluate different scenarios and select the most optimal solution.

BPM in healthcare is a crucial aspect of improving efficiency, quality, and patient outcomes. The healthcare domain is increasingly adopting BPM techniques to streamline operations and enhance care delivery. By analyzing and modeling existing processes, organizations can identify bottlenecks, inefficiencies, and areas for improvement. By leveraging BPM techniques and best practices, healthcare organizations can address the challenges they face and provide high-quality, patient-centered care.

BPM also plays a crucial role in addressing challenges specific to the healthcare domain. For instance, healthcare providers face increasing pressure to reduce operational costs while improving the quality of care (Netjes et. al, 2010). BPR initiatives can help organizations achieve these goals by optimizing processes and leveraging information technology as an enabler A good BPM permits the definition of business abilities to run the current processes, along with acclimatizing the company to a changeable context (Giacosa et al., 2018).

Business process management is the cross-functional orientation of organizations along the value chain (Lederer & Schott, 2021). Previously, to be successfully competitive, the healthcare industry had to focus on relevant technologies and procedures. According to Anjali & Patwardhan (2008), BPR in healthcare is a management approach that rethinks the current practices and processes in business and their interactions.

In essence, it attempts to improve the efficiency of such processes through a basic and radical approach by either changing or eliminating no added-value activities and by re-engineering processes. To survive, today's healthcare organizations should be business-oriented like the manufacturing industries to help meet their customers' expectations of efficient, effective, and comprehensive healthcare.

Certainly, the realization of technological benefits entails healthcare organizations making a drastic change in their current practices by focusing on a host of technical and organizational factors, including office layouts, retrievals of patient information, query processes, standard operational procedures (SOPs), work practices, guidelines, business documentation, and interactions between workers and patients. Clearly, making such a change to optimize business efficiency entails the restructuring of existing structures (Oprean, 2014).

Diamond Business System (DBS)

In this regard, the use of DBS, which was proposed by Hammer & Champy (1993), is extremely effective in helping identify the relationships between business processes, tasks and work structures, management and measurement systems as well as their values and beliefs. In particular, the restructuring of business processes within an organization may involve changing the contents of tasks and structures that could affect all employees. Invariably, these may require some changes in the management and measurement

systems within the organization. In turn, the newly changed business processes could foster new values and beliefs among practitioners, as shown in Figure 1. As such, the implementation of BPR will be complete when all elements of the DBS have been changed and aligned properly (Larsen & Andersen 2001).

Business Processes

Determine

Enable

Jobs and Structure

Values and Beliefs

Require

Induce

Management and Measurement Systems
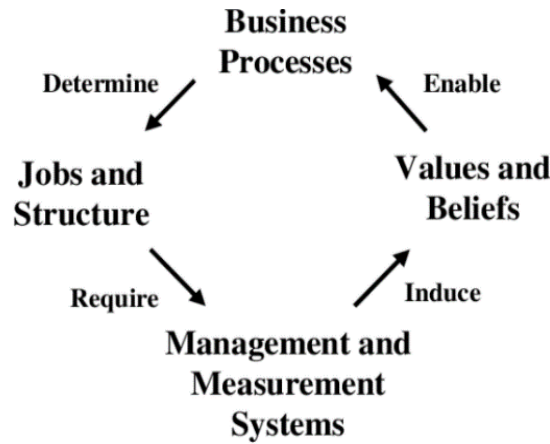
Figure 1: Diamond Business System (Resource: Hammer & Champy, 1993).

The methodology for selecting accurate BPR modeling is very important to help business entities achieve their goals and eliminate failures. According to Najjar et al. (2012), the methodologies for improving business processes have been developed and used for over 30 years. They also assert that irrespective of the strategic planning methodologies used, such as TQM, Six Sigma, and BPR, their main aims are the same – which is to streamline business processes, reduce costs, and eliminate waste, drastically altering how a particular business is run.

On the other hand, Sturdy (2010) asserts that change management is an essential requirement to facilitate the introduction of newly designed or created processes and structures into work practices and to deal effectively with workers' resistance to such changes. He further emphasizes that each methodology has its unique characteristics in terms of the purpose, level, and scope of change, thus entailing the need to identify the focus of an organization before making any changes.

From the perspective of public healthcare, Lu and Su (2010) argue that BPR has become an integral part of the healthcare system, which aims to improve healthcare services by implementing new changes or processes, such as the redesign of facilities or infrastructure. In this respect, more efforts are needed to improve the quality of the healthcare industry to help bring in more benefits for all concerned, especially for the patients (Demiris et al., 2019).

METHODOLOGY

In this study, a new hybrid methodology called *B2Lean* was proposed, which is based on a combination of the BPR and Lean Thinking methodologies. The former focuses on the use of Information Technology (IT) as a transformative enabler to radically improve the current processes. At the same time, the latter aims at eliminating waste of resources, such as products or services. Table 1 shows the comparison of the proposed B2Lean methodology with the BPR and Lean Thinking methodologies in terms of phases, implications for research, and instruments used.

Table 1: The comparison of the proposed B2Lean methodology with the BPR and Lean Thinking methodologies

	BPR	Lean	B2Lean
Phases	i) Set vision and goals. ii) Identify business processes. iii) Investigate and evaluate the processes. iv) Information Technology measures. v) Prototype processes. iv) Implementation.	i) Identify current values or processes. ii) Identify the flow of values. iii) Create the flow of values. iv) Produce the flow based on customers' choices. v) Pursue perfection.	i) Identify and analyze the *As-Is process*. ii) Identify and model the flow of values. iii) Identify the processes to be redesigned. iv) Identify the capabilities of existing information technology. v) Create the *To-Be process*. vi) Evaluate the effectiveness of the *To-be process* in relation to the *As-Is process*.
Implications for research	Radically renew current processes.	Add value to customer satisfaction by eliminating processes that have no positive values or cause waste.	Radically reform processes by eliminating wastes in the *As-Is* process that helps create the *To-Be* process.
Instrument	Information Technology	Value Stream Mapping and A3 Report.	Information Technology and Value Stream Mapping.

Table 2 highlights the description of the six phases of the proposed B2Lean model consisting of the activities, techniques, and instruments involved, with each phase comprising a sequence of steps.

Table 2: The six phases of the proposed *Lean* methodology

Phases	Activities	Techniques	Instruments
i) Identify and analyze the *As-Is process*	Discussions with the officers of MSWU to help them understand the current process (the *As-Is process*). Review documents and current practices of existing processes. Analyze the processes using the '5W 1H' technique.	Brainstorming. Document review. Flow charts. Structured observation.	Flow charts. The work procedure manual of PKSP. Monthly statistical reports. Key performance indicators. Interview questions.
ii) Identify and model the flow of values.	List each sub-process involved in the application process from the beginning to the end. Model existing processes using diagrams to represent each process and the relationship between processes (Value Stream Mapping). Identify the needs of the *As-Is* process. Propose to eliminate inefficient processes or those that do not add value.	Focus group (Brainstorming) Structured observations. Flow charts. Modeling via activity diagrams. Modeling via use case diagrams	Highlight the *As-Is* process on paper via the brainstorming technique.
iii) Identify the processes to be redesigned.	Identify the most important stages of the processes. Recognize potential variables. Select the processes that need to be redesigned. Prioritize the selected processes.	Interviews. Structured observations. Flow charts. Case diagrams. Activity diagrams.	Interview questions. Checklists. Mahjong papers. Marker pens.

iv) Identify the capabilities of existing information technology.	Identify the IT facilities available in the unit. Analyze the available IT resources that could support the new processes. Identify the levels of mastery of information systems and technology among the staff involved. Provide additional briefing or conduct courses for the new processes.	Structured observations. Free observations. Interviews.	Interview questions. Checklists.
v) Create the *To-be process*	Modify the *To-be process* based on the improvements made to the *As-Is process.* Automate the new processes as appropriate.	Activity diagrams.	Brainstorming.
vi) Evaluate the effectiveness of the *To-be Process* in relation to the *As-Is Process*	Evaluate the effectiveness of the *To-be Process* in terms of the time that could be saved in each of the redesigned processes.	Structured interviews. Activity diagrams.	Interview questions. Checklists. Mahjung papers. Marker pens.

Identifying and analyzing the *As-Is Process*

In the first phase, the details of the current application process, designated as the *As-Is process,* were examined through observations, preliminary reviews, discussions, brainstorming, and document analysis to obtain the following information:

a) The elements of the medical assistance application process (e.g., application flowcharts, each processing time, and the number of officers and forms involved).
b) Information technology and equipment used.
c) Monthly statistical reports.
d) Internal Audit Reports.
e) Client's Charter.
f) Key Performance Indicators (KPIs).
g) Working Procedure Manuals.

The above information was used to identify the inherent weaknesses of the application process. The '5W and 1H' (What, Why, When, Who, Where, and How) technique was also carried out through brainstorming to examine the flow of all processes involved, which helped reveal several issues relating to their weaknesses, as summarized in Table 3.

Table 3: Analysis of issues relating to the existing (*As-Is*) processes using the '5W and 1H' technique

5W and 1H	Issues
What	Patients have to wait too long to apply for financial assistance for treatment.

Why	The application process is too slow as it involves multiple parties.
Where	Different departments are manned by different staff.
When	Each time a patient's application is processed and handed over from the medical attendant to the MSWU officer.
Who	Medical attendant (at wards or clinics).
	Medical attendant (or MSWU) officer.
	Medical Social Work Officer.
	Hospital Director.
	Approval from relevant agencies
How	A ward or clinic staff fills in the application reference forms.
	The reference forms that have been signed off by a doctor will be sent by the medical attendant to the Medical Social Work Unit (MSWU).
	A receptionist will receive the application forms.
	An officer will check the forms and the accompanying documents.
	The applicants will be notified with the receipts of their complete application forms. Incomplete forms will be returned to the appropriate applicants.
	The officer will key in all relevant information and data into the system after receiving the complete documents.
	Each applicant will be given an appointment date for a treatment session.
	The MSW officers will prepare the socio-economic reports of patients to support their applications.
	The applications will be submitted to relevant agencies for their respective approval.
	The outcomes of the patients' applications will be notified through the mail.
Conclusion	The long delay is due to the structure of the work process which takes excessive time to complete.

Identifying and modeling the value stream mapping

In the Value Stream Mapping phase, all individuals involved in the application process, such as the heads of the unit and the healthcare assistants, were invited for a focus group session, the aim of which was to seek further improvements by refining each of the processes involved. In this phase, each process was

listed chronologically and mapped from the beginning to the end. The *As-Is Process* was modeled using a swimlane activity diagram to show the overall flow of the process. Effectively, the diagram helped highlight the start of the process, the activities and individuals involved, and the time taken by the process to complete.

After completing the mapping process, the step that followed was to identify and eliminate waste. The discussion on whether to maintain or retain a particular process and its impact was carried out through the focus group session. Strict conformance to the eight (8) waste characteristics specified in the Lean methodology had to be met before amending or eliminating a process.

Identifying the processes requiring redesign

Once the processes involved have been refined, the next step is to identify processes that need improvements through redesign or modification by performing the following tasks.
  a) Identify the most critical stages of the processes.
  b) Recognize potential variables.
  c) Select the processes requiring redesign.
  d) Prioritize the selected processes.

Identifying the processes of the medical assistance fund (MAF) requiring redesign or modification was critical to achieving the research objectives. Also, other processes that would significantly affect patients' applications were also investigated.

Identifying available Information Technology (IT) facilities

In this phase, the existing IT facilities in the MSWU that would facilitate a smooth implementation of the new application processes were examined in detail. Also, the levels of IT literacy among personnel were examined accordingly. This would help identify those requiring training that could help them perform the new processes.

Accordingly, the existing IT infrastructure was examined by focusing on the following aspects:
  a) The MSWU office has an adequate number of computers.
  b) All personnel are equipped with computers.
  c) Stable internet connectivity.
  d) The new processes can run on existing computers.

Creating and Modeling the *To-be Process*

In this phase, the *To-be Process* was designed to minimize or eliminate the weaknesses of the *As-Is process* with the following aims:
  a) To expedite the processing time.
  b) To save time.
  c) To improve processing efficiency.
  d) To improve services.
  e) To reduce costs.
  f) To share data and information.
  g) To reduce duplicates.
  h) To reduce waste in terms of materials and energy.

As emphasized, the *To-be process* would be the solution to overcome the waste of the *As-Is process* in the relevant unit. Through BPR, the information systems and IT requirements that were needed to improve existing practices were identified, both of which helped convert the *As-Is Process* to the *To-be Process,* with IT serving as the enabler for performance improvement.

Evaluating the effectiveness of the *To-be Process*

In the last phase of the proposed B2Lean methodology, the new process or the *To-be Process* was evaluated to appraise its effectiveness. Each change or modification made to the *As-Is process* was evaluated in terms of its effectiveness in reducing the processing time, energy, and cost of the medical assistance fund application.

Also, a qualitative evaluation of the new process was carried out through a case study involving interviews, checklists (for *As-Is Process* and *To-be Process*), flow charts, and several MSWU's classified documents (e.g., work procedure manual, KPI reports, appointment register book, MOH's internal audit report, and monthly statistical reports).

Formal approval for the interviews was secured after one of the MSWU's senior officers had confirmed that the interview questions were suitable and appropriate, which focused on the interviewees' demography and the weaknesses of the current processes. The questions helped probe their opinions on ways to improve the existing practices, which would serve as important inputs for the development of the To-be Process.

The time taken (measured in minutes) to complete each part of the As-Is process was investigated through observations and interviews. Specifically, the processing time was measured from the moment an application was initiated to its submission to the relevant agency

DATA ANALYSIS AND RESULTS

This section highlights the discussions of the eliminated processes, *As-Is process*, *To-Be process*, and the effectiveness of the new process as follows:

As-Is Process* versus *To-be Process

The *To-be process* was developed based on the review of the *As-Is process*, showing the justifications or reasons to keep or eliminate certain processes. The elimination of such processes was based on the seven (7) characteristics of wastes as highlighted in the Lean methodology, namely excessive production, long waiting times, excessive inventory, unnecessary movements, unnecessary transportation, defects or errors, and ineffective processes.

In this study, several processes had to be removed due to long waiting times, information errors, and unnecessary movements. Table 4 shows such processes and the justifications for their elimination. Essentially, the *As-Is process* consisted of four (4) sub-processes, namely the referral registration process, patient intervention process, socio-economic report preparation process, and approval management process.

Table 4: The sub-processes of the *As-Is Process* to be eliminated and their justifications

No	Process	*As-Is Process* to be eliminated	Justification
1.	The referral registration process.	The manual reference cases registration.	This manual process is laboriously time-consuming and will be replaced with an online registration system.
		The manual rotation process.	This process is also time-consuming, as patient information is filled in manually in the Officer Rotation Form.
		The manual issuance of appointment letter process.	This process is unnecessarily time-consuming as the medical attendant needs to fill in the same information in the appointment letter.
2.	The patient intervention process.	Checking patient attendance.	The patients' names will be manually marked on the appointment book (if they were present), which slows down the review process.
		Writing down the information of new patients in the file.	The medical attendant will fill in the same information about the patients (e.g., names, identity card numbers, addresses, and MSWU reference numbers) in the patient files. This process is redundant as such information has been documented in the previous process.
3.	The Socio-Economic Report Preparation Process.	The manual entry of patient and beneficiary information in Form A.	The MSWU officer will fill in by re-typing the information of patients and beneficiaries in Form A.
		The manual entry of patient and beneficiary information in Form B.	The MSWU officer will fill in by re-typing the information of patients and beneficiaries in Form B.
		The manual entry of patient information in the cover letter for the Medical Aid Fund.	The MSWU officer will fill in the information of patients in the cover letter.
4.	The Approval Management Process.	The manual entry of patient information with MS Excel.	The medical attendant will take a considerable amount of time to fill in the same patient information using MS Excel.
		The review of patient application approval.	The referrers have to contact MSWU by handphone or WhatsUp application to find out the current status of patients' applications.

Modeling the *As-Is Process* with the Use Case Diagram

In general, the use case diagram is normally used in software engineering to model the functional requirements of newly developed software. Given its universal utility, this diagram was used to model the *As-Is Process* based on the analysis of all information of the current situations and processes, namely the medical assistance application registration process, officers-and-patients intervention sessions, the patient socio-economic reports process, the socio-economic reports submission process, and the MAF application management process. Figure 2 shows the current application process, personnel, and their respective functions.
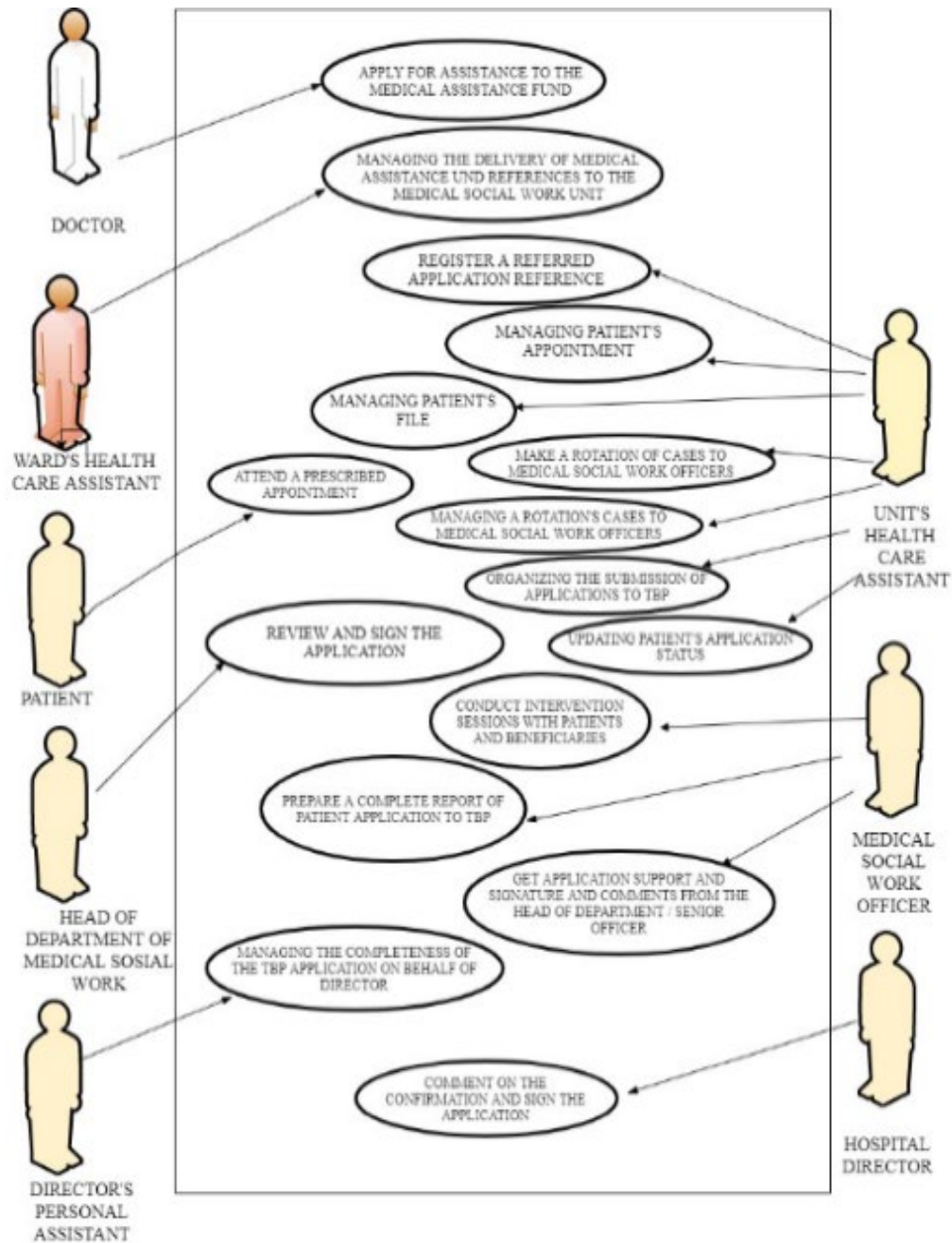
Figure 2: The current application process of the MAF fund

Modeling the *To-be Process* with Activity Diagrams

After each process needing improvement had been identified, the *To-be process* was modeled using activity diagrams, which helped compare it with the *As-Is process*. Figure 3 shows the *To-be process* model that had been updated by eliminating the overlapping, time-consuming processes. Once modeled, a mapping process was carried out to show the flow of the new processes and the personnel involved.

Figure 3 shows the example of the *To-be process* of the intervention sessions which consists of 10 processes compared to 11 in the *As-Is process*. It involves three (3) actors, namely the patients, healthcare assistants, and medical social work officers.
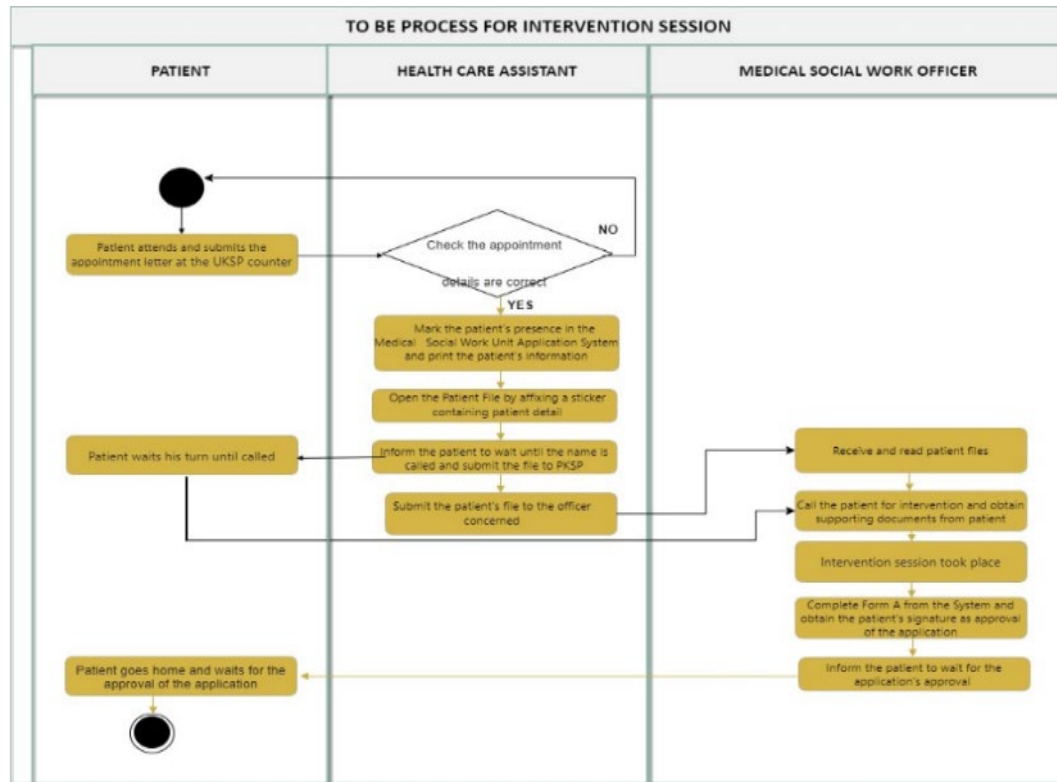
Figure 3: The activity diagrams of the intervention sessions

Patients Assistance Management System for the Medical Social Work Unit

To reduce redundant processes of the *As-Is process*, an IT division of a hospital developed an information system, called Patient Assistance Management System (PAMS), to help the medical attendant register and arrange patients' appointments and the clerical officer to prepare patients' socio-economic assessment reports.

Essentially, the functions of the new system, which are based on the suggested four (4) sub-processes of the *To-Be process* are as follows:
- The registration of reference cases.
- The patient intervention process.
- The generation of patient socio-economic reports (Form B).
- The management of the approval status of patients' applications.

The system has several functions that could help coordinate seamlessly the processes between MSWU and the referrers, such as searching a patient's information as required. Equally important, the data and information stored in the system could be shared among MSWU officers and be accessed anytime, anywhere through the Internet.

Evaluation of the *To-be Process*

As highlighted, the objective of this study is to significantly reduce the processing time, energy, and cost of the medical aid fund application process by instituting a new process. With the new process, the officers and personnel of MSWU could carry out such tasks more effectively. An impact assessment of the new process was evaluated in terms of the time it took to complete all the tasks involved in processing patients' medical assistance applications.

Operationally, the implementation of the new online application system was carried out in several phases involving several processes, which were developed based on the improvements made to the *As-Is process* by removing the laborious, time-consuming tasks or sub-processes of the *As-Is process*. In addition, problems relating to existing IT facilities or infrastructure, such as low-performance computers and a slow internet connection, have adversely affected the current application process.

Hence, the sources of such problems were investigated to ensure the successful implementation of the *To-be process*, which consists of four (4) newly improved four sub-processes. As asserted by Murtuza (2015), the use of BPR could help organizations improve their business processes through the reduction of processing time and cost and the improvement in the quality of products or services, which collectively leads to greater customer satisfaction. In light of these potential benefits, the BPR technique was used to develop a more robust, effective application process, designated as the *To-be process*, which could help improve the current practices of MSWU in managing patients' applications for medical assistance.

Differences in the processing times between the *As-Is process* and the *To-Be process*

The comparative evaluation of the *As-Is process* and *To-be process* was carried out based on the differences in the processing times of their respective sub-processes, which were measured through observations and interviews, as summarized in Table 5. As shown, for the referral registration process, the *As-Is process* and *To-be process* have nine (9) and six (6) sub-processes, respectively, whose processing times are 55 minutes and 14 minutes, respectively, resulting in a huge reduction in processing time by 41 minutes.

Likewise, a similar substantial reduction in the processing time of the patient intervention process was achieved by 49 minutes, based on the difference in the former's and the latter's processing times of 111 minutes and 62 minutes, respectively. This was made possible as the *To-be process* had only 10 sub-processes compared to the *As-Is process* which comprised 11 sub-processes.

Equally remarkable, the processing times of the patient's socioeconomic report process of the *To-be process* and *As-Is process* were 108 minutes and 248 minutes, respectively, signifying that the former was more than twice as fast as the latter, despite both having the number of sub-processes. Likewise, a similar significant reduction in the processing time of the application approval process was attainable, given the former's processing time of 37 minutes compared to the latter's processing time of 80 minutes.

Again, this was made possible as the *To-be process* had only six (6) sub-processes as opposed to the *As-Is process* which comprised 11 sub-processes. However, no improvement could be made to the socio-economic report submission process, given the constraints imposed by the current practices and policies that were beyond the control of the personnel.

Table 5: The processing times of the sub-processes of the To-be process and the As-Is process.

No	Sub-process	Processing time (in minutes)		Reduction in processing time (minutes)	Percentage of processing time used by To-be process	Percentage of processing time saved by To-be process
		AS-IS	*TO-BE*			
1	Case reference registration.	55	14	41	26 %	74 %
2	Patients Intervention.	111	62	49	56 %	44 %
3	Preparation of Socio-Economic Reports.	248	108	140	43 %	57 %
4	Submission of the Socio-Economic Reports.	33	33	0	100 %	0 %
5	MAF Application approval.	80	37	43	46 %	54 %
	TOTAL	**527**	**254**	**273**	**48 %**	**52 %**

As shown in Table 5, the *To-Be process* was able to process the registration of reference cases much faster by 74% compared to the *As-Is processes*. The former was also able to expedite the processing of patient intervention and preparation of socio-economic reports by as much as 44% and 57%, respectively. However, no such improvement could be made to the socio-economic reports submission process, given the constraints inherent in the current policy that entails each patient application to be signed off manually by the hospital director, making it impossible to be replaced by computer-assisted means.

Finally, the *To-Be process* was able to significantly reduce the processing time of the MAF application approval process by 54%. Collectively, the use of the sub-processes of the newly proposed *To-be process* could reduce the overall processing time by 52% compared to the existing process, which was a significant reduction.

DISCUSSION, RECOMMENDATION AND FUTURE WORK

In this study, a new method based on a combination of the principles of BPR and Lean Thinking methodology, called B2Lean, was proposed to help expedite the processing of patients' applications for medical assistance in Malaysian public hospitals. The development of this new method was guided by the feedback elicited through a group discussion involving seven (7) respondents where five (5) of them are Medical Social Work Officers (MSWO) and two (2) are Health Care Assistants in the MSWU unit. They were purposely selected in this study given their vast experience and knowledge of the current practice of handling such applications.

In this study, the '5W 1H' technique was used to gather the relevant information about the current process. The '5W and 1H' technique, which stands for Who, What, When, Where, Why, and How, is chosen for examining the flow of processes because it provides a comprehensive framework for understanding and analyzing various aspects of a process. This technique, which is similar to the Zachman Framework, can help highlight in detail a business process (Abdel-Fattah et al., 2017; Gunawan & Liejaya, 2020). Additionally, an analysis of existing documents was conducted to reveal relevant information that could help improve the current processes.

Finally, a brainstorming session, field observations, and structured interviews were carried out, with the former being particularly important in gaining insight into how to improve the existing application process or the *As-Is process*.

The Diamond Business System (DBS) model was also adopted to help conceptualize the B2Lean method,

which could help implement BPR in the medical aid application in a government hospital in Malaysia. Particularly, the use of the DBS model was extremely helpful, given its ability to highlight the changes that could occur when a company re-engineers its business processes (Hammer & Champy, 1993; Choi, 2019; Dengiz et al., 2006). The same scholars also assert that one of the important criteria to achieve success in BPR is to ensure that everything is done based on the principles of the DBS model, as it helps identify the relationships between business processes, tasks, and work structures, management and measurement systems as well as values and beliefs.

According to this model, the business process determines the work structures that in turn require a management and measurement system. As such, the use of this model in BPR could significantly improve existing processes in terms of cost, time, and quality (Panayiotou et al., 2017; Hammer & Champy, 1993). In light of these potential savings, it is, therefore, important for organizations facing a myriad of problems, such as high operating costs, low-quality products or services, and long delivery time, to implement BPR to improve their current business practices (Zaini & Saad, 2019).

As analyzed, the impact of the new process, the *To-be process*, on expediting the current practice of processing patients' applications for medical assistance is potentially significant, helping to reduce the overall processing time by slightly more than half of the existing process. From the medical perspective, this significant reduction could help save more lives and improve patient's quality of life, as patients could receive prompt treatments or medical interventions without delays due to redundant or unnecessary processes. Clear start and end points can be defined, along with a fixed set of activities performed to achieve a certain goal (Jans & Laghmouch, 2022). Premised in this study' context, the needs of end-users or organizations refer to the applications of patients seeking medical treatments.

Arguably, instituting new practices is extremely challenging as personnel or workers may not be receptive or supportive. Hence, organizations intending to introduce organizational changes may need sound change management. Research consistently emphasizes the critical role of change management in the successful implementation of BPR projects (Rrezaie et al., 2013; Park, 2018). According to Sturdy (2010), change management is an essential requirement to facilitate the introduction of newly designed or created processes and structures into work practices and to effectively deal with workers' resistance. This entails a thorough examination of the purpose, level, and scope of change to help organizations focus on the various processes of their business that need improvements.

In this study, such business processes were determined and highlighted by using standard Unified Modeling Language (UML) diagrams including use case diagram and swimlane activity diagram. Specifically, the use case diagram helped show the boundaries or scopes of the tasks of the current process, while the swimlane activity diagrams helped identify activities and tasks carried out by a specific person and their workflows throughout the entire application process.

On the other hand, the activity diagram helped identify and remove ineffective business processes consisting of overlapping or repetitive tasks. As demonstrated, such diagrams were an effective means to identify such processes, as the graphical representation of a business process helps the stakeholders to understand how a business process is performing and to allow them to communicate, interact, and cooperate more efficiently (Abdel-Fattah et al., 2017).
To ensure that new work structures are soundly workable, an effective management system is required. In the context of this study, the business process involves a range of tasks, starting from the moment a counter officer receives the patients' applications to the final moment when they are sent to the hospital director for approval. Given the problems inherent in the existing practice, an online system called the Patient Assistance Management System (PAMS), was proposed as an effective tool to help expedite the

application process by removing inefficient tasks. In today's digital realm, such a novel system serves as a technology enabler to help organizations manage and control their business activities more efficiently (Gunawan & Liejaya, 2020).

As demonstrated in this study, individuals involved in implementing BPR could experience new values and benefits deriving from the new business process, the *To-be process*, as they could perform their tasks more efficiently and smoothly using PAMS, with data and information becoming more accessible through a centralized database.

The use of the *To-be process* is expected to have a significant impact on the current practices, as processes deemed time-consuming, which can potentially cause massive backlogs, have been eliminated based on the seven (7) waste characteristics of the Lean Thinking methodology. With the improved efficiency of the new process, the MSWU's personnel would be able to gain new values and benefits, making their working lives more fulfilling and rewarding.

Arguably, such benefits could be realized through BPR, as this technique can help improve an organization's productivity through the reduction of processing time and cost and the improvement in the quality of products or services rendered, leading to greater customer satisfaction (Murtuza, 2015). Lately, BPM has become one of the most widely used approaches for the design of modern organizational and information systems, which emerged from the consolidation of disciplines that share a belief that a process-centered approach could lead to substantial improvements in both performance and compliance of a system (Abdel-Fattah et al., 2017).

Future studies in this field should connect Customer Relationship Management (CRM) and BPR since they are interconnected in numerous ways, particularly in terms of optimizing organizational efficiency and improving customer satisfaction. Both CRM and BPR rely on data to inform decision-making and performance evaluation. By leveraging CRM data alongside other operational data sources, organizations can identify inefficiencies, identify areas for improvement, and measure the impact of BPR initiatives on customer satisfaction and business outcomes.

Data-driven insights enable organizations to continuously refine their processes and strategies to better serve customers. Overall, CRM and BPR are complementary disciplines that share a common goal of improving organizational performance and customer satisfaction. By integrating CRM systems and data with BPR initiatives, organizations can optimize their processes, enhance customer relationships, and achieve sustainable competitive advantage.

This study has a limitation in that it was only investigated in one public hospital in Malaysia. Thus, it is proposed that the implementation of BPR in the administration of support applications for patients in hospitals be expanded to other hospitals in Malaysia. It is also suggested that its adoption be extended to other procedures in hospitals to have a more dramatic influence on the management and performance of this public hospital in particular, as well as government hospitals in Perak and Malaysia in general.

CONCLUSION

The findings of this study would have a significant impact on the management of medical assistance applications currently being practiced by the MSWU's personnel. A new methodology of re-engineering new business processes called *B2Lean*, which is based on the BPR and Lean Thinking methodology, was

proposed to help replace ineffective processes (the *As-Is process*) with new, improved processes (the *To-be process*).

The modeling of the *As-Is process* and the *To-be process* revealed a significant reduction in the overall processing time of slightly more than 50%. Additionally, almost all of the manual data-entry tasks were replaced with an online system, called Patient Assistance Management System (PAMS), which could help meet the stakeholders' and practitioners' needs. For example, using this novel system, patients could receive automatic alerts via WhatsApp or Short Messaging System (SMS) applications on their mobile devices to inform the status or progress of their applications.

In conclusion, it could be reasonably argued that putting in place the new process could help practitioners improve the current practice of handling patients' applications for medical assistance. In particular, such an improvement could help patients receive prompt medical interventions to improve the quality of their health. In addition, the lessons learned from the proposed B2Lean methodology could be used as a guideline for organizations seeking to improve their current practices.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used ChatGPT to enhance the clarity of the writing. After using ChatGPT, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

DATA AVAILABILITY STATEMENT

Data available within the article or its supplementary materials.

REFERENCES

Abdel-Fattah, M. A., Khedr, A. E., & Aldeen, Y. N. (2017). An evaluation framework for business process modeling techniques. *International Journal of Computer Science and Information Security, 15*(5), 382-392.

Akua, A.O. (2014). Time management and administrative effectiveness: Lessons for educational administrators. *Global Research Journal of Interdisciplinary Social Sciences, 3*(4), 12-19.

Bayomy, N., Khedr, A., & Abd-Elmegid, L. (2021). Adaptive model to support business process reengineering. *Peer J Computer Science, 7*:e505. https://doi.org/10.7717/peerj-cs.505

Bayomy, N. A., Khedr, A. E., & Abd-Elmegid, L. A. (2024). A configurable mining approach for enhancing the business processes performance. *Knowledge and Information Systems,* 1-24. https://doi.org/10.1007/s10115-023-02011-4.

Bhavsar, K., Shah, V., & Gopalan, S. (2019). Process life cycle framework: A conceptual model and literature study of business process re-engineering for software engineering management. *CiiT International Journal of Software Engineering and Technology*, *11*(6), 096-100.

Butt, J. (2020). A conceptual framework to support digital transformation in manufacturing using an integrated business process management approach. *Designs, 4*(3), 17. https://doi.org/10.3390/designs4030017.

Kissflow. (2024, January 19). Business process modeling: Definition, benefits, and example. Retrieved from https://kissflow.com/workflow/bpm/business-process-modeling/

Chen, C.-K., & Tsai, C.-H. (2008). Developing a process re-engineering-oriented organizational change exploratory simulation system (PROCESS). *International Journal of Production Research, 46,* 4463-4482. https://doi.org/10.1080/00207540601182286.

Choi, T.-M. (2019). Blockchain-technology-supported platforms for diamond authentication and certification in luxury supply chains. *Transportation research Part E: Logistics and transportation review*, 1*28*, 17-29. https://doi.org/10.1016/j.tre.2019.05.011

Dengiz, B., Bektas, T., & Ultanir, A. (2006). Simulation optimization based DSS application: A diamond tool production line in industry. *Simulation Modelling Practice and Theory*, *14*, 296-312. https://doi.org/10.1016/j.simpat.2005.07.001

Demiris, G., Oliver, D. P., & Washington, K. T. (2019). Chapter 3 - Defining and analyzing the problem. In *Behavioral intervention research in hospice and palliative care: Building an evidence base* (pp. 27-39). Elsevier. https://doi.org/10.1016/B978-0-12-814449-7.00003-X

Eder, J., & Franceschetti, M. (2020). *Time and business process management: Problems, achievements, challenges* [Paper presentation]. 27th International Symposium on Temporal Representation and Reasoning (TIME 2020).

Edwards, J., & Crisp, D. (2016). Seeking help for psychological distress: Barriers for mental health professionals. *Australian Journal of Psychology*, *69*(3*)*, 218-225. https://doi.org/10.1111/ajpy.12146

Fetais, A., Abdella, G.M., Al-Khalifa, K.N., & Hamouda, A. (2022). Modeling the relationship between business process reengineering and organizational culture. *Applied System Innovation*. *5*(4), 66. https://doi.org/10.3390/asi5040066

Hameed, N.S., Salamzadeh, Y., Rahim, N.F., & Salamzadeh, A. (2021). The impact of business process reengineering on organizational performance during the coronavirus pandemic: Moderating role of strategic thinking. *Foresight*, *24*(5), 637-655. https://doi.org/10.1108/FS-02-2021-0036

Gartner, D., & Padman, R. (2017). Mathematical programming and heuristics for patient scheduling in hospitals: A survey. In *Handbook of research on patient safety and quality care through health informatics* (pp. 478-501). IGI Global. https://doi.org/10.4018/978-1-5225-3926-1.ch021

Giacosa, E., Mazzoleni, A., & Usai, A. (2018). Business Process Management (BPM): How complementary BPM capabilities can build an ambidextrous state in business process activities of family firms. *Business Process Management Journal*, *24*(5), 1145-1162. https://doi.org/10.1108/BPMJ-07-2017-0211

Gunawan. W. and Liejaya, B. (2020). Formulating cloud based hospital information system (HIS) with Zachman framework. *In IOP Conference Series: Materials Science and Engineering*. 725, 012092. https://doi.org/10.1088/1757-899X/725/1/012092

Gianchandani, E. P. (2011). Toward smarter health and well-being: An implicit role for networking and information technology. *Journal of Information Technology*, *26*(2), 120-128. https://doi.org/10.1057/jit.2011.5

Hammer, M. and Champy, J. (1993). *Reengineering the corporation: A manifesto for business revolution*. Harper Collins, New York.

Larsen, M.H., & Andersen, N.B. (2001). From reengineering to process management-a longitudinal study of BPR in a Danish manufacturing company. *In Proceedings of the 34th Hawaii International Conference on System Sciences.*

Lederer, M., & Schott, P. (2021). Business process management. *In Encyclopedia of Organizational Knowledge, Administration, and Technology* (2287-2302). IGI Global. https://doi.org/10.4018/978-1-7998-3473-1.ch158

Li, B., Ma, X., Yu, Y., Wang, G., Zhuang, N., Liu, H., ... Fu, W. (2020). Delivery of high-quality and efficient medical care. In M. Xie & Z. He (Eds.), *Artificial Intelligence in Medical Diagnosis and Treatment* (pp. 147-161). Springer. https://doi.org/10.1007/978-981-32-9603-9_9

Jans, M., & Laghmouch, M. (2022). Process mining for detailed process analysis. In *Proceedings of the International Conference on Advanced Information Systems Engineering*. 123-145. https://doi.org/10.1007/978-3-031-11089-4_9

Lu, Z., & Su, J. (2010). Clinical data management: Current status, challenges, and future directions from industry perspectives. *Open Access Journal of Clinical Trials*, 93-105.

Meerten, M., Rost, F., Bland, J., & Garelick, A. I. (2014). Self-referrals to a doctors' mental health service over 10 years. *Occupational Medicine (London)*, *64*(3), 172-176. https://doi.org/10.1093/occmed/kqt177

Najjar, L., Huq, Z., Aghazadeh, M., & Hafeznezami, S. (2012). Impact of IT on process improvement. *Journal of Emerging Trends in Computing and Information Sciences, 3*(1), 67-80.

Netjes, M., Mans, R. S., Reijers, H. A., van der Aalst, W. M. P., & Vanwersch, R. J. B. (2010). BPR best practices for the healthcare domain. In S. Rinderle-Ma, S. Sadiq, & F. Leymann (Eds.), *Business process management workshops. BPM 2009* (Lecture Notes in Business Information Processing, Vol. 43).

Oprean, V.B. (2014). Business (re) eEngineering: Management of the risk induced constraints. *Procedia – Social and Behavorial Sciences, 109,* 815-826.

Panayiotou, N. A., Stavrou, V. P., & Gayialis, S. P. (June 2015). The application of a business process modeling architecture in the supply chain of a manufacturing company: A case study. The 4th *International Symposium & 26th National Conference on Operational Research, Chania, Greece*.

Park, K. O. (2018). The relationship between BPR strategy and change management for the sustainable implementation of ERP: An information orientation perspective. *Sustainability, 10*(9), 3080. https://doi.org/10.3390/su10093080

Rrezaie, K., Bakhtiar, O., Samadi, H., Mohammadi, M., & Nazari-Shirkouhi, S. (2013). Learning organisations, strategic deployment and change management strategy for enhancing successful implementation of BPR projects. *International Journal of Business Innovation and Research, 7*, 61-83.

Scheruhn, H.-J., von Rosing, M., & Fallon, R. L. (2015). Information modeling and process modeling. In M. von Rosing, A.-W. Scheer, & H. von Scheel (Eds.), *The complete business process handbook* (pp. 515-554). Morgan Kaufmann.

Sturdy, G.R. (2010). *Business process reengineering: Strategies for occupational health and safety.* Cambridge Scholars Publishing.

Wright, P., Bingham, L., Taylor, S., Hanif, N., Podmore, E.J., & Velikova, G. (2012). Managing social difficulties: Roles and responsibilities of patients and staff. *Psycho-Oncology, 21*(1), 20–8. https://doi.org/10.1002/pon.1858

Zaini, Z., & Saad, A. (2019). Business process reengineering as the current best methodology for improving the business process. *Journal of ICT in Education (JICTIE), 6*, 66-85. https://doi.org/10.37134/jictie.vol6.7.2019