

BUSINESS PROCESS MODELING OF INDONESIAN HUMAN MILK BANK BASED ON BANK FRAMEWORK USING BPMN - CASE STUDY: LACTASHARE

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Abstract: In Indonesia, human milk sharing initiatives have yet to adequately implement the donor process in accordance with medical standards, government regulations, and Islamic law. It is imperative to employ the BANK framework developed by the PATH organization to model the human milk donor business process. The present study employs a comparative method, integrating qualitative and quantitative analysis, to compile a model from various national and global regulatory sources and religious law which visualized through BPMN diagrams, derived from a case study conducted at Lactashare. The simulation findings demonstrate the efficacy and efficiency of the proposed model in comparison to the existing method, with potential savings of up to 32% in total fixed expenses and an operational enhancement of 18 hours and 48 minutes. However, to ensure the validity of the results, a comparison with those obtained using more advanced tools and techniques is necessary. Collaboration among human milk banks in Muslim countries is encouraged to facilitate the exchange of best practices, support research initiatives, and assist policymakers in formulating policy solutions that align with religious law while ensuring the smooth operation of human milk banking.

Keywords: BANK (Base, Awareness & Advocacy, Network, Key Protocols) framework, Business Process Modeling and Notation (BPMN), Human Milk Bank

INTRODUCTION

The practice of formal human milk donation in Indonesia typically occurs in hospitals equipped with a Neonatal Intensive Unit (NICU). However, informal donation sites can also be found throughout communities (Nofitasari, 2021). These communities use various forms of social media to disseminate information about their donation activities. These informal practices pose significant health risks to infants receiving donor human milk. The milk is likely to be contaminated with infectious diseases carried by the donor mother and may contain bacteria or microbes due to improper handling during pumping, storage, and transportation.

Moreover, the use of human milk from multiple donor mothers complicates the identification of the donor mother's origin. In Islamic law, the two families involved in the human milk donation process become siblings, who are prohibited from marrying each other. Therefore, it is essential to store and manage donor and recipient data accurately. In Indonesia, a foundation, known as Lactashare, has been managing donor human milk since 2018. This non-governmental organization (NGO) is a pioneer in the realm of formal milk sharing activities. Lactashare operates in accordance with Islamic law, as outlined in Majelis Ulama Indonesia (MUI) fatwas and global medical guidelines related to the donor human milk process (Atika Nur

Annisa, 2021; M. Taufiq Agiel & Putra, 2022).

Despite the efforts made, there are several other significant requirements stipulated by the guidelines of donor human milk management organizations that have yet to be fully implemented by Lactashare and other informal milk sharing practitioners in Indonesia. It is necessary to undertake the following: 1). Develop a model for the human milk donor business process that adheres to health guidelines, government regulations in Indonesia, and Islamic law; 2). Evaluate the created model to refine and validate it. The proposed model is imperative to ensure the safety and quality of donated human milk, prevent the transmission of infectious diseases, maintain the nutritional and immunological content of human milk and storing a database of human milk donors and recipients and using it wisely for human milk donation purposes. This will provide infants in need with high-quality human milk while respecting cultural, religious contexts and government regulations.

The objective of this research is to utilize the BANK framework (Base, Awareness & Advocacy, Network, and Key Protocols) to model the human milk donor process in accordance with these three regulations. The BANK framework was initiated by the Program for Appropriate Technology in Health (PATH) in 2013. It provides guidance in establishing fundamental requirements and developing a comprehensive mission for milk banks to provide safe donor human milk that saves infants' lives. Numerous studies have underscored the

pivotal role of human milk banking in enhancing infant health, particularly among premature and at-risk infants. The present study emphasizes the necessity for a structured framework and standard practices in human milk banking, which closely align with the principles outlined by the BANK framework developed by PATH (DeMarchis et al., 2017; Santos & Perrin, 2022). The establishment of human milk banks in Indonesia must proceed without conflict, as in Pakistan, where differences of opinion among communities contributed to the failed establishment of the first human milk bank at the Sindh Institute of Child Health and Neonatology (SICHN) in Korangi, Karachi (Nasir, 2024).

METHODOLOGY

This research employs a comparative study method, integrating qualitative and quantitative analysis, to develop a model derived from various sources of national and global regulations, as well as religious laws. The results of the qualitative analysis are utilized in the simulation process, while the results of the quantitative analysis are employed in model creation. The research process involved the following stages: literature review, field study, data collection, gap analysis, model creation, and testing and evaluation.

Literature Review

The comprehensive literature review encompasses an examination of extant research, comprising literature from diverse sources such as books, academic journals, and prior studies. The review focuses on topics related to Donor Human Milk (DHM), Human Milk Bank (HMB), Lactashare, Framework

BANK, and Business Process Modeling and Notation (BPMN).

Field Study

A field study was conducted by researcher at the Human Milk Donor Foundation, Lactashare, located in Malang. The primary activities of Lactashare include the collection, processing, and distribution of human milk from donors to recipients in accordance with medical and religious principles, particularly Islam. The field studies were conducted to provide a detailed picture of the issues being raised in this research. The three principles that were of particular concern were to be modeled in the human milk donation process.

Data Collection

The data collection process was methodically executed in phases, entailing oral and written interviews with the founder and several expert staff members of Lactashare who oversee the management of donor, recipient, and matching data. This period of data collection spanned from August 2023 to April 2024. The dataset employed in the matching process was derived from primary data sourced from Lactashare. Additionally, the researcher obtained data on the current business process of operating human milk donors at Lactashare, including the steps, personnel involved, and tools used.

Gap Analysis

The researchers summarized the similarities and differences in the recommendations used to meet international health standards, which were obtained from several global organizations, namely: World Health Organization (WHO), National Institute for Health and Clinical Excellence

(NICE), Human Milk Banking Association of North America (HMBANA), European Milk Banking Association (EMBA), and Program for Appropriate Technology in Health (PATH). To ensure the safety and quality of human milk donations in Indonesia, human milk donor operators must align these guidelines with regulations issued by the Indonesian government. Additionally, a comparative analysis of fatwas, resolutions, and recommendations issued by organizations authorized to issue fatwas related to Islamic law in Malaysia, Singapore, Europe, the Arabian Peninsula, and Egypt was conducted. The final step in this phase is to identify the BANK framework and map Lactashare's business processes to that framework.

Model Creation

The initial step involves comprehending the four primary components constituting the BANK framework: Base, Awareness & Advocacy, Network, and Key Protocols. Subsequently, a mapping process was undertaken, wherein medical standards, MUI fatwas, and government regulations were juxtaposed with the BANK framework. This mapping was facilitated using BPMN (Business Process Management) diagrams. Thereafter, the researcher developed a proposed model in the form of a BPMN diagram, employing the Bizagi Modeler 4.0 tool. During the model's development, the researcher engaged in communication and deliberation with Lactashare's founder. These results are in accordance with the hypothesis that the proposed model can be used as a guideline for the operation of human milk banks in Indonesia or other countries.

Testing and evaluation

This evaluation involves a meticulous simulation and analysis process. The

utilization of business process simulation is instrumental in the post-design or -redesign phase of process development. This simulation enables a comprehensive evaluation of process efficiency prior to implementation. During the simulation process, researchers meticulously collect data on process performance indicators such as cycle time, resource utilization, and throughput. Subsequent to this, several scenarios are systematically compared to assess the impact of modifications and identify the optimal process configuration. Consequently, an analysis is conducted to interpret the data generated by the simulation.

RESEULTS AND DISCUSSION

Proposed Business Process Modeling

The development of a business process model for operating a human milk bank in Indonesia that complies with medical regulations, government regulations, and Islamic law involves the integration of existing business processes at the Lactashare foundation with guidelines established by human milk bank associations and international health organizations. This approach encompasses the integration of business processes currently operational within the Lactashare foundation, complemented by guidelines from prominent human milk bank associations and international health organizations, including HMBANA (North America), EMBA (Europe), and NICE (UK). Additionally, the model draws upon best practices in human milk bank operations from countries such as Brazil, France, India, Poland, and Vietnam, aligning with the BANK (Base, Awareness & Advocacy, Network, and Key Protocols) framework and muslim scholar fatwas.

Figure 1 below is a BPMN diagram from Bizagi Modeler version 4.0 that illustrates the proposed model for the human

milk donation process at the human milk bank, which can be emulated and implemented by human milk banks that will operate in Indonesia.



Gambar 1. Proposed Model for Human Milk Donation Process in Indonesia

Proposed Model Simulation Results Analysis

The researchers conducted three types of simulations: process validation, time analysis, and resource analysis. Following the establishment of the parameters for each process, the simulation can be executed on Bizagi Modeler. The results demonstrate a discrepancy in resource utilization and the overall process between the existing process and the proposed model.

Resource Utilization

A comparison of the two business processes reveals a discrepancy in the number of human resources allocated to each. The proposed model stipulates that human resources assigned to ASI bank are to be specialized according to best practices in ASI bank organizations worldwide. Conversely, the staff working at Lactashare are collectively referred to as customer service, despite the presence of distinct job descriptions. The following section presents the results of resource utilization in both the existing and proposed models, simulated over a duration of 30 days (1 month).

Tabel 1. Utilization in Existing Process
(Lactashare)

Resource	Utilization	Total fixed cost	Total unit cost	Total cost
Doctor/ Lactation Counselor	12.22%	Rp 6,600,000	Rp -	Rp 6,600,000
Customer Service 2	77.11%	Rp 8,970,000	Rp -	Rp 8,970,000
Customer Service 3	87.69%	Rp 2,895,000	Rp -	Rp 2,895,000
Customer Service 5	92.82%	Rp 420,000	Rp -	Rp 420,000
Customer Service 6	62.50%	Rp 4,035,000	Rp -	Rp 4,035,000
Total		Rp 22,920,000	Rp -	Rp 22,920,000

Tabel 2. Resource Utilization in Proposed Model

Resource	Utilization	Total fixed cost	Total unit cost	Total cost
Courier	31.39%	Rp 1,130,000	Rp -	Rp 1,130,000
HSE (Health, Safety & Environment) Staff	99.17%	Rp 1,530,000	Rp -	Rp 1,530,000
Nutritionist	94.77%	Rp 450,000	Rp -	Rp 450,000
Lactation Physician/Cou nselor	60.00%	Rp 10,500,000	Rp -	Rp 10,500,000
Neonatologist	54.58%	Rp 6,400,000	Rp -	Rp 6,400,000
Administration Staff	21.76%	Rp 4,230,000	Rp -	Rp 4,230,000
Digital Marketing Staff	27.78%	Rp 5,000,000	Rp -	Rp 5,000,000
IT Staff	31.67%	Rp 5,350,000	Rp -	Rp 5,350,000
Legal Staff	46.67%	Rp 350,000	Rp -	Rp 350,000
Laboratory Staff	94.77%	Rp 450,000	Rp -	Rp 450,000
Total		Rp 35,390,000	Rp -	Rp 35,390,000

Description of each column in table 1 & 2:

- Utilization: Shows the percentage of time the resource is busy during the simulation. The utilization calculation uses the following formula:

$$\text{Utilization (\%)} = \frac{\text{(Total processing time by resource)}}{\text{Total available time}} \times 100\% \quad (1)$$

- Fixed cost: The cost generated each time the resource processes a token in a task, regardless of the time spent.
- Cost per hour: The cost generated for each hour the resource is used in a task, regardless of the number of tokens processed.

Total fixed cost: Shows the fixed cost component for using the resource, where instances started is the number of tokens to be processed.

$$\text{total fixed cost} = \text{activity cost} \times \text{instances started} \quad (2)$$

- Total unit cost: Shows the variable cost component for using the resource.
- Total cost: Shows the total cost of using the resource

$$\text{total cost} = \text{total fixed cost} + \text{total unit cost} \quad (3)$$

A comparison of the total cost in Table 1 with Table 2 reveals that the human milk bank business process model proposed by the researcher necessitates an increased allocation of human resources. This adjustment is made in accordance with the recommendations outlined in the BANK framework, which stipulates the employment of personnel with expertise in the health sector, particularly in the domains of breastfeeding activities and human milk donation. It is imperative to consider the utilization of human resources to ensure that staff members do not experience burnout due to excessive workload. Excessive resource utilization can adversely impact the performance and quality of service to donors and recipients, as well as other relevant parties, thereby indirectly affecting the performance of the human milk bank. While the proposed model necessitates a considerable investment in resources, this aligns with the BANK framework,

particularly with regard to the stipulation of training and capacity building as a prerequisite for the establishment of a human milk bank.

Business Process

Tables 3 and 4 represent the whole business process, which is the next topic of discussion in the simulation findings.

Tabel 3. Simulation Results of Existing Model (Lactashare)

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)	Total fixed cost
Human Milk Donation Process at Lactashare	Process	30	200	130	40572	11497.4	4860030	Rp25,135,000
Donor Registration	Task	109	109	0	0	0	0	Rp-
START	Start event	200						
Recipient Registration	Task	91	91	0	0	0	0	Rp-
Pasted?	Gateway	88	88					
Distribution of donor human milk	Task	181	181	1560	22850	10740.1105	1943960	Rp9,050,000
Pasteurization and storage of donor human milk	Task	181	181	0	0	0	0	Rp-
Pasted?	Gateway	112	112					
Giving to baby	Task	181	181	0	0	0	0	Rp-
Sending human milk to Lactashare	Task	93	93	0	0	0	0	Rp-
Receiving & storing donor human milk	Task	93	93	2350	8130	6474.408602	602120	Rp1,860,000
FINISHED	End event	19						
Recording the provision of donor human milk	Task	27	28	1440	33420	16384.4444	442380	Rp700,000
Receiving booklet & certificate of nursing sibling	Task	11	11	0	0	0	0	Rp-
Therapy/treatment according to doctor's recommendation	Task	0	0	0	0	0	0	Rp-
Checking registration data	Task	200	200	10	2251	1114	222800	Rp1,000,000
Donor / Recipient?	Gateway	200	200					
Exclusive Gateway	Gateway	200	200					
FINISHED	End event	0						
FINISHED	End event	11						
Parallel Gateway	Gateway	11	11					
Parallel Gateway	Gateway	11	11					
Are the recipient baby's needs met?	Gateway	27	27					
Donor Interview	Task	112	112	120	5370	3552.678571	397900	Rp2,800,000

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)	Total fixed cost
Recipient Interview	Task	88	88	60	3110	1587.045455	139660	Rp2,200,000
Matching donor-recipient profiles	Task	181	181	1140	7610	5274.088398	954610	Rp4,525,000
Issuing booklet & certificate of breastfeeding milk-kinship	Task	11	12	7320	21660	14236.36364	156600	Rp3,000,000

Tabel 4. Simulation Results of Proposed Model

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)	Total fixed cost
Proposed Model of Human Milk Donor Process in Indonesia	Process	69	200	159	36638	10369.56232	1940113	Rp17,010,000
START	Start event	200						
Donor & Recipient Recruitment	Task	200	200	60	11801	5930.5	1186100	Rp2,000,000
Donor/Recipient?	Gateway	200	200					
Donor Registration	Task	114	114	0	0	0	0	Rp-
Recipient Registration	Task	86	86	0	0	0	0	Rp-
Sending human milk to Human Milk Bank	Task	99	99	120	1090	550.6060606	54510	Rp2,970,000
Storing donor human milk	Task	22	22	40	16235	2144.090909	47110	Rp440,000
END	End event	15						
Passed?	Gateway	114	114					
=Passed?	Gateway	86	86					
END	End event	40						
Storing donor human milk	Task	14	14	0	0	0	0	Rp-
Giving donor human milk to baby	Task	14	14	0	0	0	0	Rp-
Are recipient baby's needs met?	Gateway	14	14					
Monitoring donor human milk provision	Task	14	14	1440	18600	10020	140280	Rp330,000
Receiving Sibling Booklet & Certificate	Task	14	14	0	0	0	0	Rp-
Receiving Sibling Booklet & Certificate	Task	14	14	0	0	0	0	Rp-
Therapy/treatment as recommended by doctor	Task	40	40	15	135	26.25	1050	Rp1,000,000
END	End event	14						
Parallel Gateway	Gateway	14	14					
Parallel Gateway	Gateway	14	14					
Recipient Interview	Task	86	86	60	310	80.98837209	6965	Rp2,150,000
Donor Interview	Task	114	114	30	220	42.06140351	4795	Rp2,850,000
Processing donor human milk	Task	14	15	2880	59200	20192.14286	281850	Rp750,000
Distributing donor human milk	Task	14	14	13400	14960	13933.21429	195345	Rp700,000
Issuing Booklet & Certificate of Breastfeeding Milk-kinship	Task	14	14	1440	1440	1440	20160	Rp3,500,000
Matching donor-recipient profiles	Task	60	60	10	270	31.5	1890	Rp300,000

Description of each column in table 3 & 4:

- Name: Identifying a specific BPM form whose results are displayed.
- Type: Identifying the type of BPM form element.
- Instances completed: Indicates the number of tokens processed during the simulation.

- Instances started: Indicates the number of tokens that arrived at each task.
- Minimum time: Indicates the minimum amount of time the simulated token remains in the BPM form before being processed.
- Maximum time: Indicates the maximum amount of time the simulated token remains in BPM form before being processed.
- Average time: Indicates the average amount of time simulation tokens remain in the BPM form before being processed.
- Total fixed cost: Indicates the total cost of performing the task during the simulation according to the formula (3).

The simulation process has demonstrated that the proposed standardized human milk donor business process model is both effective and efficient, with a total fixed cost reduction of 32% for the entire process. Furthermore, the proposed model exhibits a faster completion time for a single cycle of human milk donation, with an average of 18 hours and 48 minutes, as compared to the existing process. The model has been shown to ensure the quality and safety of human milk in accordance with the BANK framework. However, the researcher observed variability in the instances, instances initiated, and times presented in the simulation results when multiple simulations were conducted using Bizagi Modeler. This variability can lead to changes in the final simulation results, suggesting the need for a more comprehensive and accurate approach to ensure the reliability of the results. To ensure the reliability of the results, it is essential to employ more robust tools for testing and evaluating the human milk donor

business process within the proposed model. The most accurate testing and evaluation can be conducted once the human milk donation process at this human milk bank is fully operational in Indonesia.

CONCLUSION

The utilization of BPMN diagrams in the depiction of the human milk donor process facilitates the comprehension of the business flow by stakeholders lacking technical backgrounds. The implementation of a standardized human milk donation process is anticipated to rectify the deficiencies that have been observed in both formal and informal human milk donation processes currently in operation in Indonesia. By formulating a comprehensive business process model for human milk banks that aligns with international health standards while adhering to Islamic religious laws, Indonesia can ensure the well-being of newborns, guarantee the safety and quality of donated human milk, and address the cultural and religious sensitivities of the Muslim community.

The simulation has demonstrated a 32% reduction in total fixed costs when compared to the human milk donation process currently employed at the Lactashare Foundation. The simulation requires an average of 7 days, 4 hours, and 49 minutes to complete a single cycle of the human milk donation process, which is only 18 hours and 48 minutes longer than the process utilized at Lactashare. It is crucial to note that the simulation results are merely representative and must be validated through additional simulations employing different tools to ensure the attainment of more precise outcomes. The novel human milk donor model adheres to the BANK framework, which prioritizes the safety and quality of human milk. Consequently,

complying with stringent standards at each stage of human milk donation, including collection, processing, and distribution, is imperative. This model necessitates the expertise of professionals with specialized competencies in the domain of human milk donation and breastfeeding, such as physicians, lactation counselors, neonatologists, nutritionists, HSE staff, and laboratory personnel.

The integration of international guidelines with local and religious regulations has the potential to influence various aspects of management, including operational efficiency, adherence to regulations, stakeholder trust, and organizational effectiveness.

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