







Figure 1. Numbers of Blood Donors in BTU of Surabaya City

Generally, the condition of donor fluctuation for other BTUs experience the same phenomenon and it can be seen from the value of deviation standard as Figure 2.

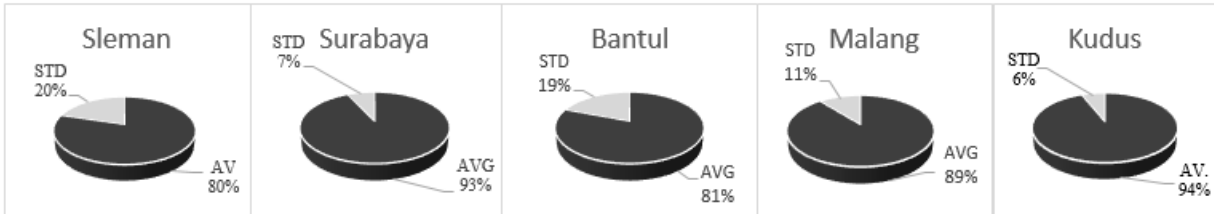


Figure 2. Deviation standard of blood supply

Based on the interview results, the blood bags fluctuation impacts in each BTU can be describe as Table 3.

Table 3. Impacts of Uncertainty Blood Bags Supply on Blood Bank Availability

BTUs	Stock Availability		Statements
	Over	Under	
U1	√		(+) "In order to fulfil the target, there is no difficulty at all because there are blood donor communities in each district. Therefore, our supply tends to be overstock"
U2	√		(+) "When there are blood donor programs from corporations, the schedule may not fit but it cannot be changed. Therefore, our supply may be overstock"
U3	√		"Because of the high sense of social sensitivity of the citizens, we tend to have overstock of blood bags so we send some of them to other BTUs."
U4	√		"Ever since 2015, we have problems in distributing the blood bags because we often have over stock."
U5		√	"Almost every month we ask for more supply from the BTU of Yogyakarta City to fulfil the demand."
U6	√		"We often ask the other BTU (Gunung Kidul Regency to take some of our supply)."
U7		√	"We rarely experience the over stock, and we often ask for more supply from the other BTUs."

## 2. Demand Uncertainty

Another problem that emerged in BTUs is the difficulty in predicting blood bags demand from the hospitals. It happens because of the stochastic demand and is often referred to as uncontrollable demand. Some of the BTUs (U1, U2, U4, U5, U6, and U7) provided statements regarding the demand accuracy, specifying that 90% of accuracy prediction is considered as a good thing. Even the BTU of Surabaya City stated that 80% of accuracy prediction is good. The data of demand fluctuation is presented as Figure 3.

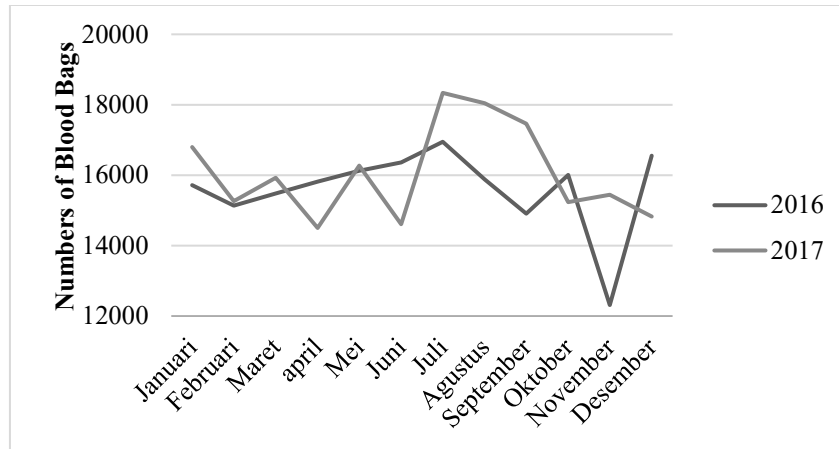


Figure 3. Numbers of Blood Donors in BTU of Surabaya City

The blood demand fluctuation in each blood bank can be seen from the deviation standard of demand, as described at Figure 4.

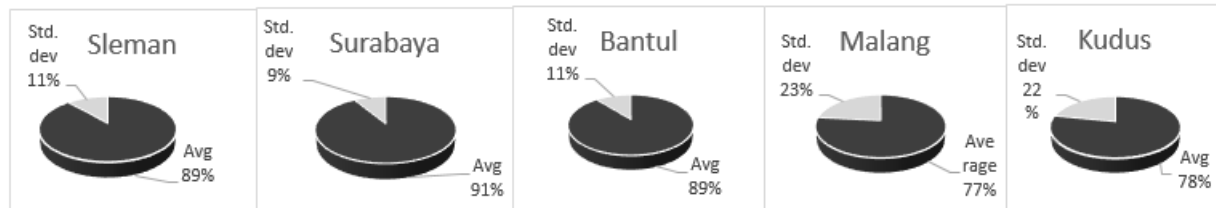


Figure 4. Deviation standard of blood demand

### 3. Product Perishability

Besides causing opportunity loss, blood bags expiration contributes to financial disadvantages to the BTUs; it is because of the high production cost and the disposal cost for expired products (Mansur et al, 2018). The percentage rates of expiration level in each BTU compared to its production level per month ( $X_{un}$ ) mentioned at Table 4.

Table 4. Percentage Rate of Expiration Level

BTUs	Percentage rates of expiration ( $X_{un}$ )
U1	$5\% \leq X_{U1}$
U2	$10\% \leq X_{U2}$
U3	$10\% \geq X_{U3}$
U4	$10\% \geq X_{U4}$
U5	$2\% \leq X_{U5}$
U6	$10\% \leq X_{U6}$
U7	$2\% \leq X_{U7}$

## 4. Discussion

Blood supply chain management model in Indonesia could be categorized as decentralized mode, in which each district carries out an independent planning and distribution system. Based on the exploratory study, the analysis could be resumed as follows:

### The Strengths and Weaknesses of the Indonesian blood supply system

Strengths:

1. The decentralization model eases the access of donors in donating their bloods. (S1)
2. It facilitates the consumers to get the blood supply because each city has BTU/ blood bank. This reduces trouble in accessibility caused by the poor condition of the road and the possibility of congested traffic, which can delay the blood supply. (S2)

3. High sense of social responsibility of the Indonesian citizens can be the factor to get blood supply easily.(S3)

Weaknesses:

1. The non-regular blood donors are still dominant compared to the regular donors; it can cause high supply of blood bags fluctuation. (W1)
2. The planning system in each BTU is still considered low in response to the market needs, as each consumer has specific characteristics in term of age range, quality, and cost. (W2)
3. There is no good coordination among the stakeholders, for example between hospitals and the BTU or among the BTUs. It may cause the stock runs out or the increasing risk the expiration rate.(W3)
4. The number of population in each city or regency and the education level gap may cause some BTUs experiencing over stock while the others experiencing under stock.(W4)
5. The technology gap among the BTUs in production process may cause different quality of the products that can affect the society trust to BTUs and impede the coordination among BTUs.(W5)

### **Opportunities and threats identified in the Indonesian blood supply system**

Opportunities:

1. Large numbers of population can be used as reserved supply of blood bags, especially in emergency situations.(O1)
2. The possibility among BTUs to have coordination to collaborate in planning and operational stages. (O2)
3. Rapidly developed technology can be an advantage to improve management models to be more innovative to keep the blood bags availability and monitor the blood life cycle.(O3)

Threats:

1. There is a new competitor to BTUs, as a result of the government new policy that some hospitals can receive blood donation and production process. It will make the BTUs no longer the only organization that allowed managing blood system in Indonesia. (T1)
2. The new technology in blood production process may make some of the production equipment owned by the BTUs become obsolete and cannot be used any longer.(T2)

The major challenges experienced by the BTUs are the demand uncertainty, supply uncertainty and perishable characteristics of blood bag product, that will lead to the outdated inventory and stock out risk. Based on SWOT analysis, the weaknesses that related to W1, W2, W3, W4 and W5 are presumed as the main causes for outdated inventory and stock out inventory. BTUs need to find precise solution to settle it, by considering correlation between weakness factor and relevant opportunity as defined in the Table 5.

Table 5. Correlation Weakness and Relevant Opportunity

Weakness	Opportunity	Propose Action
W1	O1,O2	Planning Collaboration
W2	O2, O3	Planning and Operational Collaboration
W3	O2	Planning and Operational Collaboration
W4	O2	Planning and Operational Collaboration
W5	O3	Planning and Operational Collaboration

The collaboration strategy between BTU can be an alternative to overcome the problems faced in the blood supply chain. The collaboration could be performed by horizontal collaboration among BTUs or vertical collaboration between BTUs and hospitals. Since all BTUs are experiencing the same issues, good horizontal collaboration is required to overcome the problems. Collaboration has many benefits to improve organization performance, such as demand sharing, resource sharing, also risk sharing (Simatupang & Sridharan, 2012; Simatupang & Sridharan, 2005; Mansur, et al 2018). Designing integrated inventory system among the BTUs is one of the collaboration strategies to improve blood supply chain performance. Demand and capacity sharing approach is the possible operational technique to be applied. This operational technique is proposed because each BTU has unique demand and capacity. The demand and capacity gap of each BTU will be solved if there is strong cooperation among the BTUs. However, to improve collaboration in BTUs, there are several constraints such as:

1. Some BTUs are still hesitant to formalize the collaboration, even though all BTUs are under the IRC, they are independent organizations that take care of their own viability, such as the staffs' salary, development cost, etc. It may become a concern that the collaboration will bring negative impacts to the organization.
2. There is no a collaboration model yet, that can meet the organization necessity, which is a potentially independent social organization.

To initiate this collaboration among the BTUs, these are several steps to be considered:

1. Improving the awareness of each BTU about vision and mission in delivering excellent service.
2. Building mutual trust among BTUs to support information sharing.
3. Designing appropriate collaboration strategy to gain optimum inventory performance.
4. Conducting evaluation and corrective action from the applied collaboration strategy.

## **5. Conclusion**

Blood management system in Indonesia, which is handled by the BTUs, follows a decentralization model. It needs some improvements especially in managing the inventory system. The special challenges to be solved are overcoming the stock out and expired products. Collaboration among the BTUs can be used as an alternative to improve the management, particularly in planning and operational stages. Nowadays, there are still several constraints in implementing the collaboration, both technical and non-technical. Steps that need to be done in building collaboration between BTUs are building awareness about business risks, building trust between BTUs, designing collaboration systems, and evaluating systems to make improvements. Further research is expected to build a flexible collaboration model among the BTUs in order to commit to the obligations as individual organization as well as improve collaboration. The simulation approach may help to design collaboration model to accommodate the complexity of blood management problems.

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**Agus Mansur** is a Lecturer in Department of Industrial Engineering, Universitas Islam Indonesia (UII), Yogyakarta. Currently he is a Doctoral Student at Industrial Engineering Department in Institut Teknologi Sepuluh Nopember (ITS), Surabaya. He has a Master Engineering Science in Industrial Management from UNSW, Australia. His research interests are in supply management, risk management and quality management. He can be reached on [agusmansur@uii.ac.id](mailto:agusmansur@uii.ac.id) or [agusmansur.am@gmail.com](mailto:agusmansur.am@gmail.com).

**Iwan Vanany** is a Professor of Business Process Reengineering in the Department of Industrial Engineering at the Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia. He received his PhD degree from Universiti Teknologi Malaysia (UTM) in Manufacturing and Industrial Engineering and both Master's and Bachelor's degrees in Industrial Engineering Department from ITS. His research interests are in the business process management, food supply chain management, and operations management. He has published in International Journal of Information System and Supply Chain Management, Meiji Business Journal, Supply Chain Forum: An International Journal, International Journal Logistics Systems and Management and Journal of Islamic Marketing (forthcoming). He teaches business process reengineering, supply chain management, enterprise resources planning (ERP), logistics management, and productions and planning control.

**Niniet Indah Arvitrida** is a Lecturer in Department of Industrial Engineering, Institut Teknologi Sepuluh Nopember (ITS), Indonesia. She holds a PhD in Simulation Modeling at Loughborough University, UK. She also has a Master of Engineering in Supply Chain Management and Bachelor of Engineering in Industrial Engineering, both obtained with honors (*cum laude*) in ITS, Indonesia. Her research interests are simulation (agent-based modelling, system dynamics, and discrete-event simulation) and supply chain management. She can be reached on [arvietrida@gmail.com](mailto:arvietrida@gmail.com) or [niniet@ie.its.ac.id](mailto:niniet@ie.its.ac.id).