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ESTIMATION OF MILITARY CASUALTIES DURING WARS AND CONFLICTS

Nowadays, humanity still experiences wars between nations, although we expect mankind to evolve and leave military conflicts behind. Thus, it would be beneficial to create a model for forecasting potential casualties and losses due to military actions between countries to grasp the enormous waste of resources that could be used more productively. The main aim of the model is to show that wars are not effective because of massive losses and that all conflicts should be solved peacefully.

The model is made for an imaginary country with a population of 5 million, where both men and women could serve, and the military-age population is half of all citizens. However, the model still lacks proper shocks, for instance, big military operations, so it shows basic behavior, but can be enhanced in the future. Simulation time is measured in Days and lasts for 200 days with the possibility to prolong the simulation.

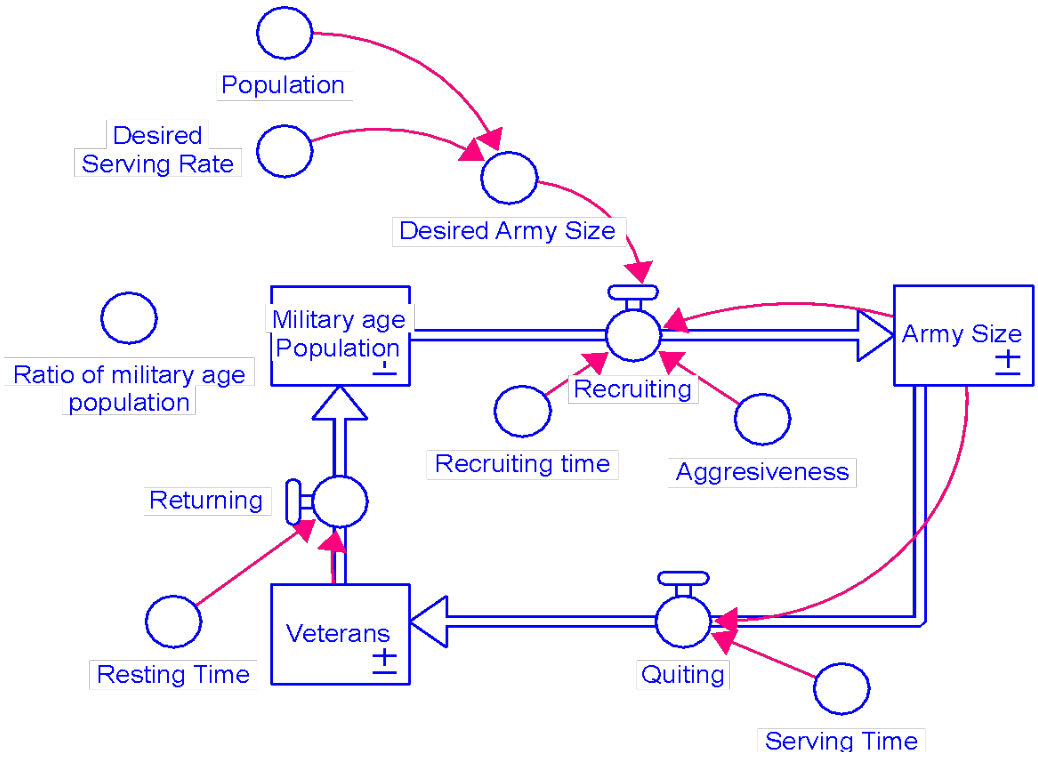

Figure 1. System Dynamics Model

Firstly, army personnel is recruited from the military-age population based on the concept of 1st order information delay as shown in Figure 1, where army size is trying to adapt to desired army size taking into account recruitment time for a single soldier and aggressiveness with which the army headquarters wants to enroll new recruits. Desired army size, in its turn, is just a product of desired serving rate and size of the population.

Obviously, every army bears losses during wartime which are divided into battle and non-battle casualties (Figure 2). The main difference between them lies in the cause of receiving an injury as they can be received due to combat as well as due to ordinary illnesses and pandemics. Non-battle casualties simply depend on some accidence rate of soldiers catching illnesses or chronic diseases per day, while battle casualties estimation is much more complex.

On the other side, battle casualties are a product of encounters per day and the average amount of casualties per encounter as presented in Figure 2. Encounters per day are the product of active front length and the mean number of encounters per 1 kilometer of the frontline to the power of intensity of combat in the area in case of active operations or battles for strategically important areas. By default, the intensity is set to 1, but it can be used for modeling intensifying of combat due to, for example, political reasons or the invention of a new weapon. In their turn, casualties per encounter are tied to average casualties, the comparative level of equipment between opposing armies, and the casualties ratio. The casualties ratio takes the form of an S-shape growth of the ratio of the enemy's army share, therefore, the higher is share of the enemy's army the exponentially bigger the casualties ratio would be.

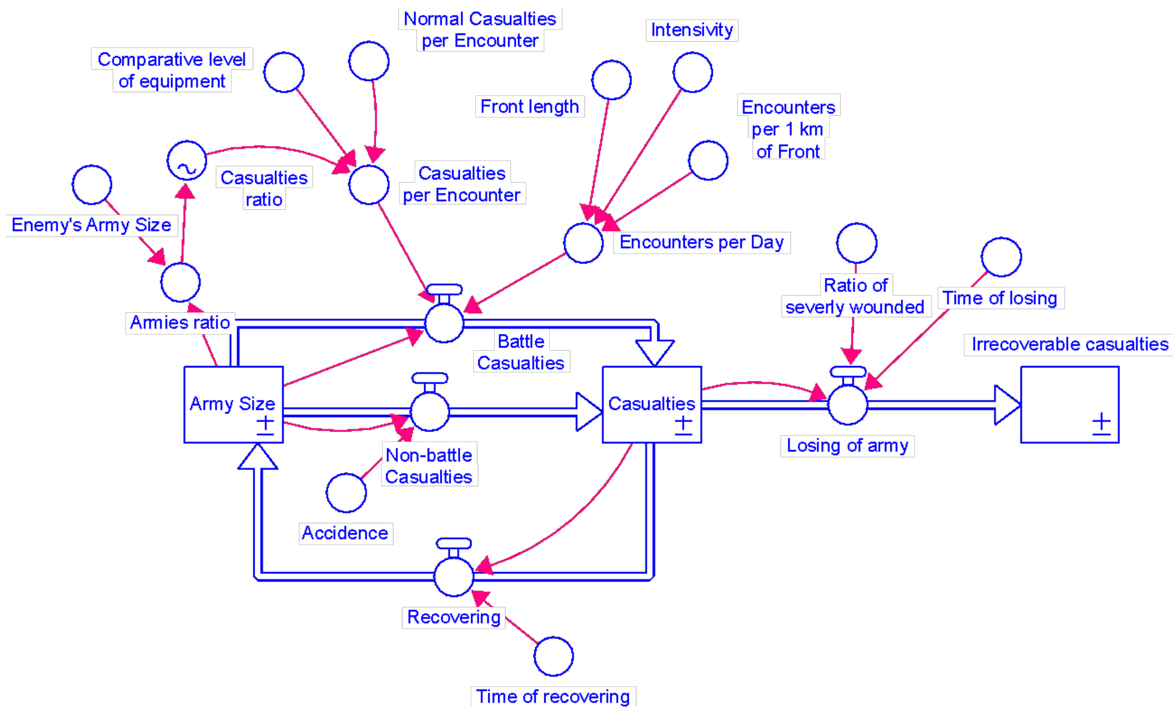

Figure 2. Battle and non-battle casualties

Injured servicemen can either die or recover, however, not all of them can die in the future. Only severely wounded soldiers can be lost in hospitals or directly on the battlefield. We assume that this ratio is constant and in out, the model is equal to 1% of all casualties. The whole process of accumulating irrecoverable losses can be described as 1st order material delay of the product of the ratio of severely wounded soldiers and all casualties as shown in Figure 2. On the other hand, most of the injured soldiers return to the army with some recovering time measured in days and the whole process looks like 1st order material delay as well.

After serving in the army for some period troops can be rotated to the reserve and become veterans, however, they can still be conscripted after some time in the rear. Those 2 processes can be described as 1st order material delay, although, there is a place for improvement as not all veterans will return to the active force or some of them will not rotate at all and the contracts often have fixed serving time.

Talking about the behavior, the model shows that after the start of the war army's size deteriorates quickly and stabilizes after approximately 20 days while the number of casualties spikes. Since then both casualties and the number of soldiers slowly rise as the government tries to adapt the army's size to the desired level with given aggressiveness. It is worth mentioning that the model does not reflect any potential shocks coming from big military operations, therefore it still needs improving.

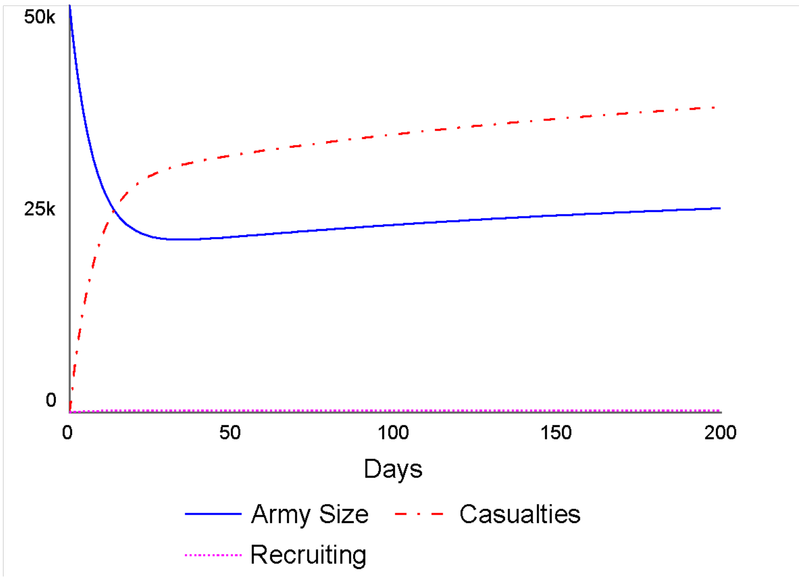

Figure 3. Behavior of the model

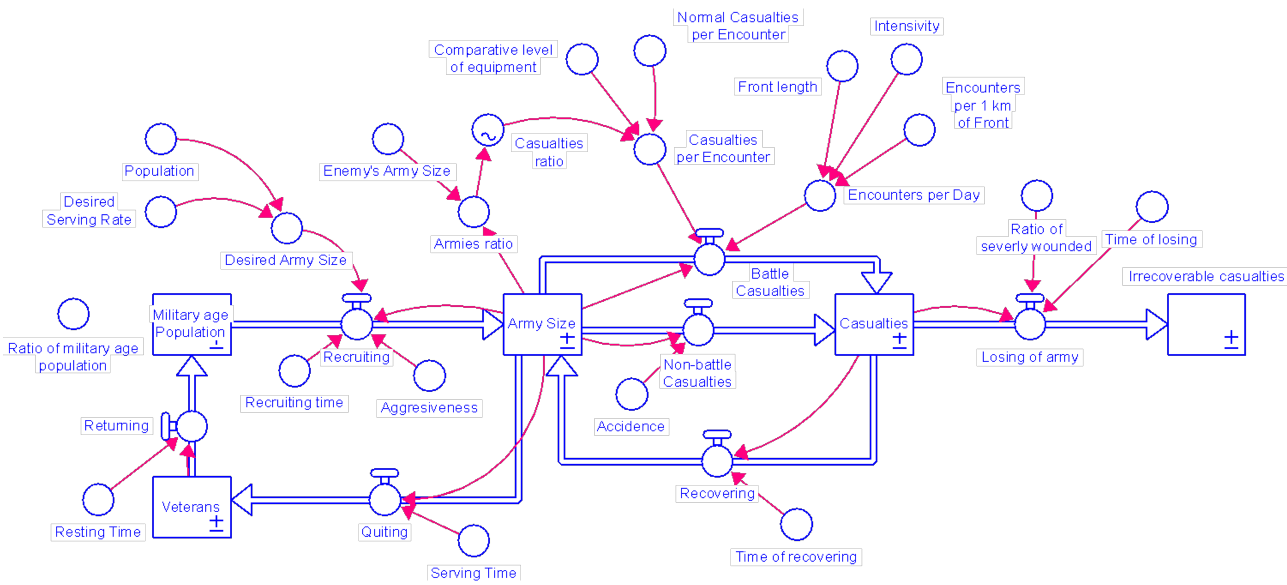

Figure 4. Overall look of the model

To summarize, we created a model (Figure 4) that shows how the size of the army changes during wars and conflicts. The government wants to adapt the army size by recruiting personnel from the military-age population. We have two types of casualties: battle and non-battle casualties. Because of them some people die or get severely wounded, so the army size decrease. Another part of personnel recovers. After spending some time in the military, they become veterans but some of them after a few months return to the military-age population.

References

1. Shone, R. (2003). An introduction to economic dynamics. Cambridge University Press. pp. 92-97.
2. Sterman, J. D. (2000). Business Dynamics: System Thinking and Modeling for a Complex World. New York, Irwin. McGraw-Hill. 982 p.
3. Wheat, D. I. (2007). The Feedback Method: A System Dynamics Approach to Teaching Macroeconomics. PhD thesis, University of Bergen.
4. Лук'яненко, І., Віт, Д. (2017). Системний аналіз формування державної політики в умовах макроекономічної дестабілізації.
5. Лук'яненко, І., Віт, Д., Оліскевич, М. (2020). Фінансова політика в умовах тінізації та дисбалансів на ринку праці: методологія та інструментарій.