SYSTEM DYNAMICS MODELING OF MONGOLIAN CASHMERE SECTOR (VENSIM MODEL)

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Background and problem

Mongolia is the second largest producer of cashmere in the world, with the remaining 48% produced by China and 12% by Iran and Afghanistan. Because cashmere fiber is nanostructured, it is very soft, light, warm, flexible, breathable, fireproof and eco-friendly. Such desirable characteristics make cashmere as one of the highly sought-after product in many developed, high-end luxury markets. [11].

In Mongolia exporting of raw cashmere is prohibited. Therefore, most of the cashmere is exported after washing process to China, after dehairing/combing to Italy, England, and Japan. In addition, cashmere knit products or other end-products are exported to over 20 countries such as USA, Germany, Korea, Japan, Belgium and France [2], [8], [9].

As of 2018, Mongolia has annual production capacity of 14000 tons of washed cashmere, 6220 tons of dehaired washed cashmere, 4350 tons of tops and 1300 tons of spun yarn. It is also able to produce about 5 million pieces of finished end-products including 2.8 million pieces of knit and 2 million woven products. However, the sector suffers from rigorous unused excess capacity, using only 82% of its washing capacity, 33% of combing, 40% of spinning, 60% of knitting and 65% for weaving. Only 16% of Mongolia's raw cashmere ends up as finished products in the value chain in the country. [2], [4], [8].

Purpose

A dynamic simulation model is created on cashmere sector in Mongolia with following aims:
- To see what opportunities and difficulties might occur if 60% of raw cashmere is fully processed to final end-product within the country.
- To analyze the effect of imposing export taxation on washed and dehaired cashmere in order to increase the processing level of domestic production
- To give a forecast of the whole cashmere sector in Mongolia in the medium and long term.

Model Structure

- Covers all stages of value chain in cashmere sector in Mongolia:
- Validity of model is from 2012 to 2030.
- Historical numerical data of last 7 years
- Covers 15 deep-processing factories, 23 primary processing factories, 59 small-medium sized factories for knit clothing and 150-200 small workshops.

  - ○ *Goat*
  - ○ *Raw material preparation*
  - ○ *Washing*
  - ○ *Dehairing / Combing*
  - ○ *Spinning*
  - ○ *Weaving*
  - ○ *Knitting*
  - ○ *Finished products and sales*
  - ○ *Domestic sales*
  - ○ *Foreign sales*
  - ○ *Total income and taxation*
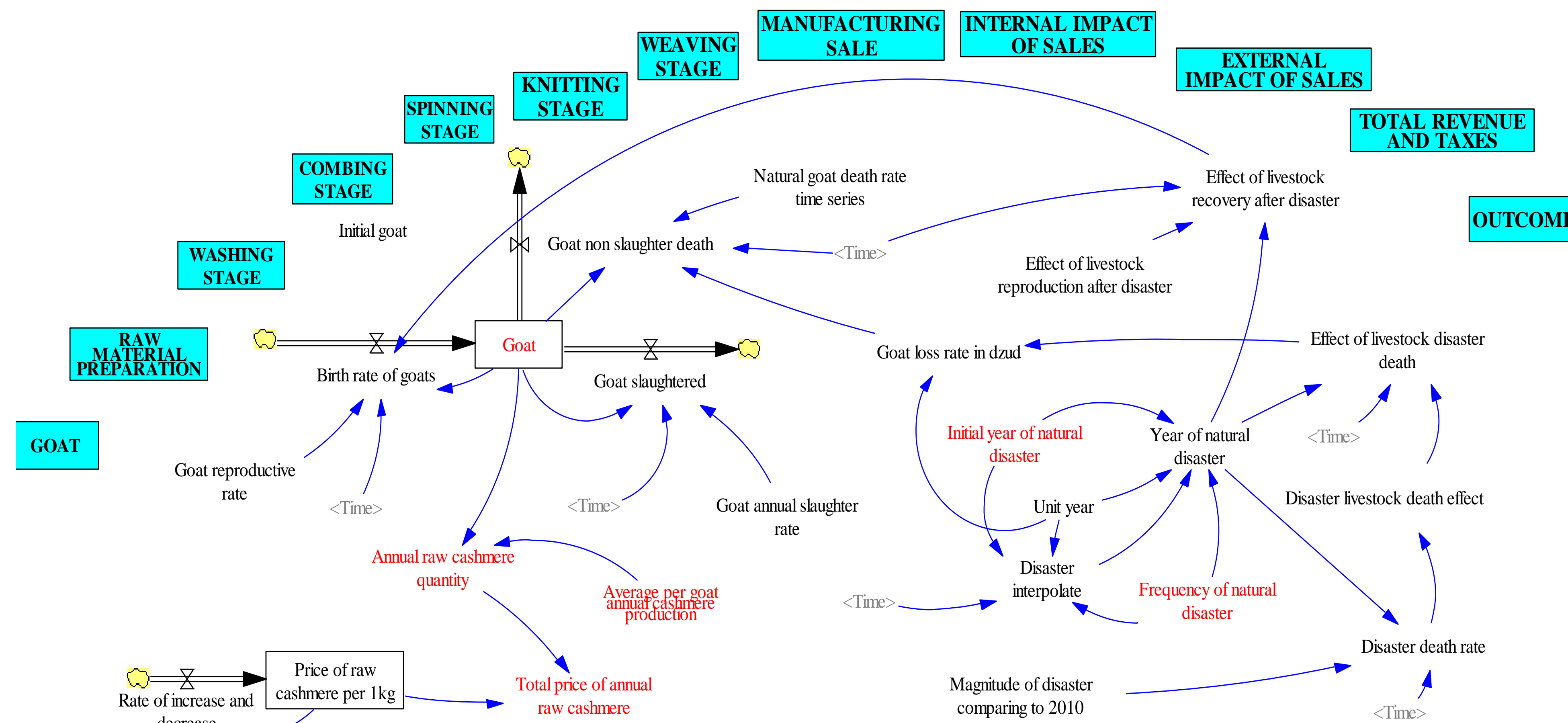 - ○ *Results*

Model

Figure 1. Dynamic Model for Goat stage

"Goat" is the first stage of the value chain. From the dynamic model, we can easily see the number of goats and yield of raw cashmere in Mongolia. The model shows that a price of cashmere will remain comparatively high, thus causing herders to have more goats than other livestock. It means that it means that number of goat will not decrease in the near years. Average yield of one goat has been increasing in the last years /from 250-280gr to 330 gr/, however it has been negatively influencing the cashmere quality [5].
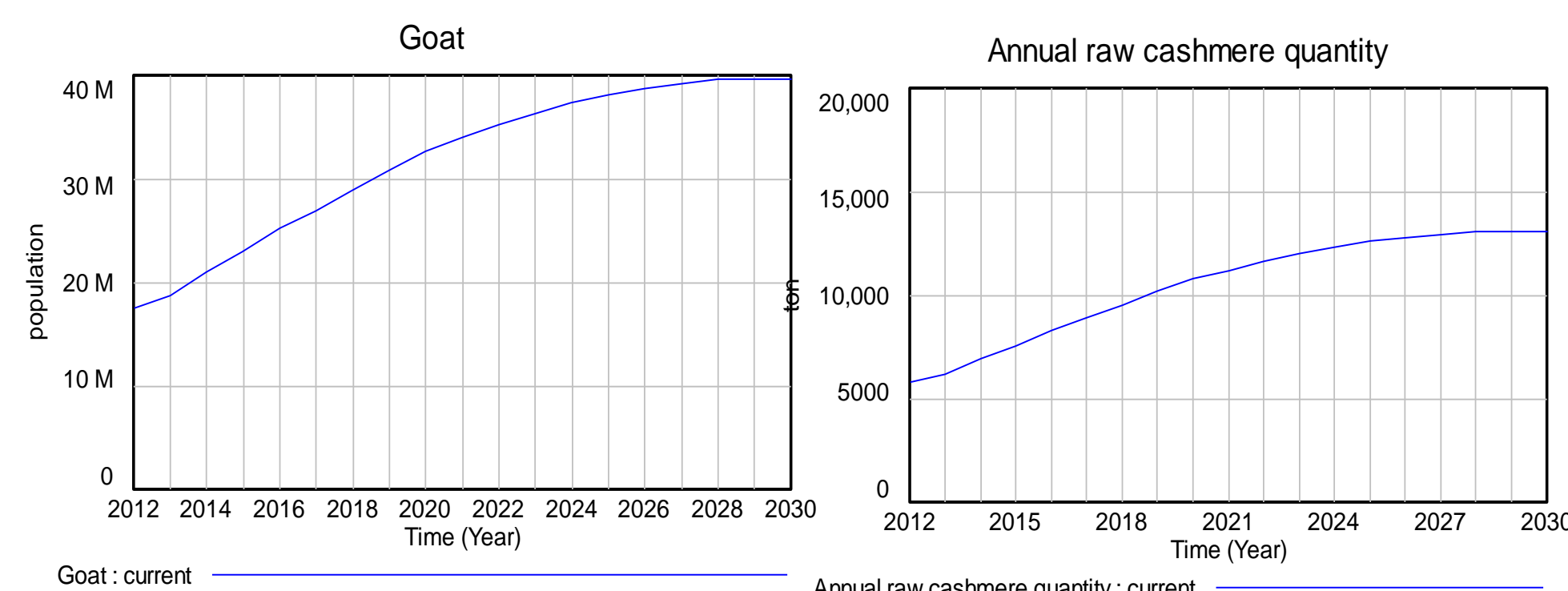
Increasing number of goats will have adverse effect in structure of livestock, cashmere quality and grazing capacity. So we need better "quality over quantity" policy to improve goat's efficiency instead of increasing its numbers.
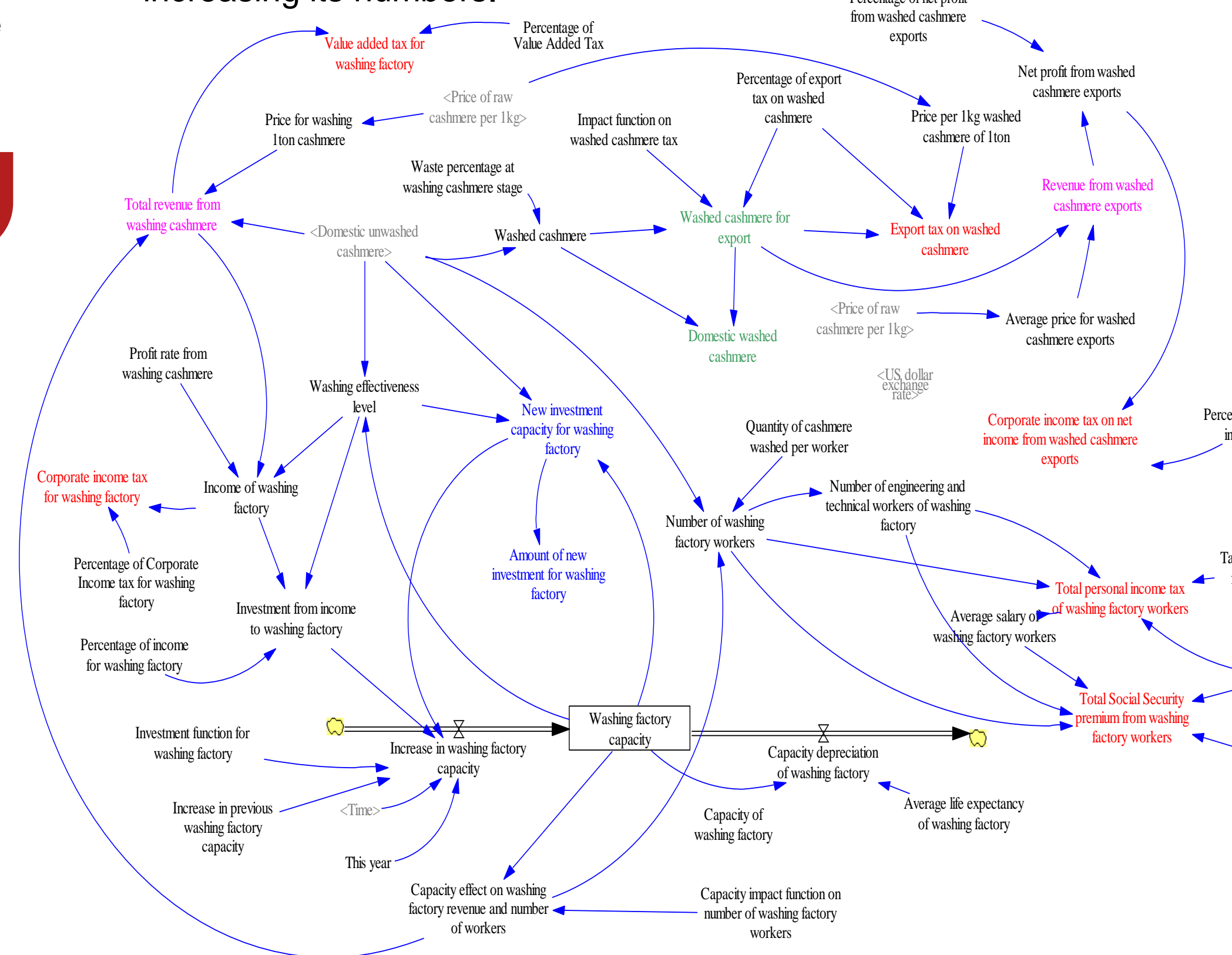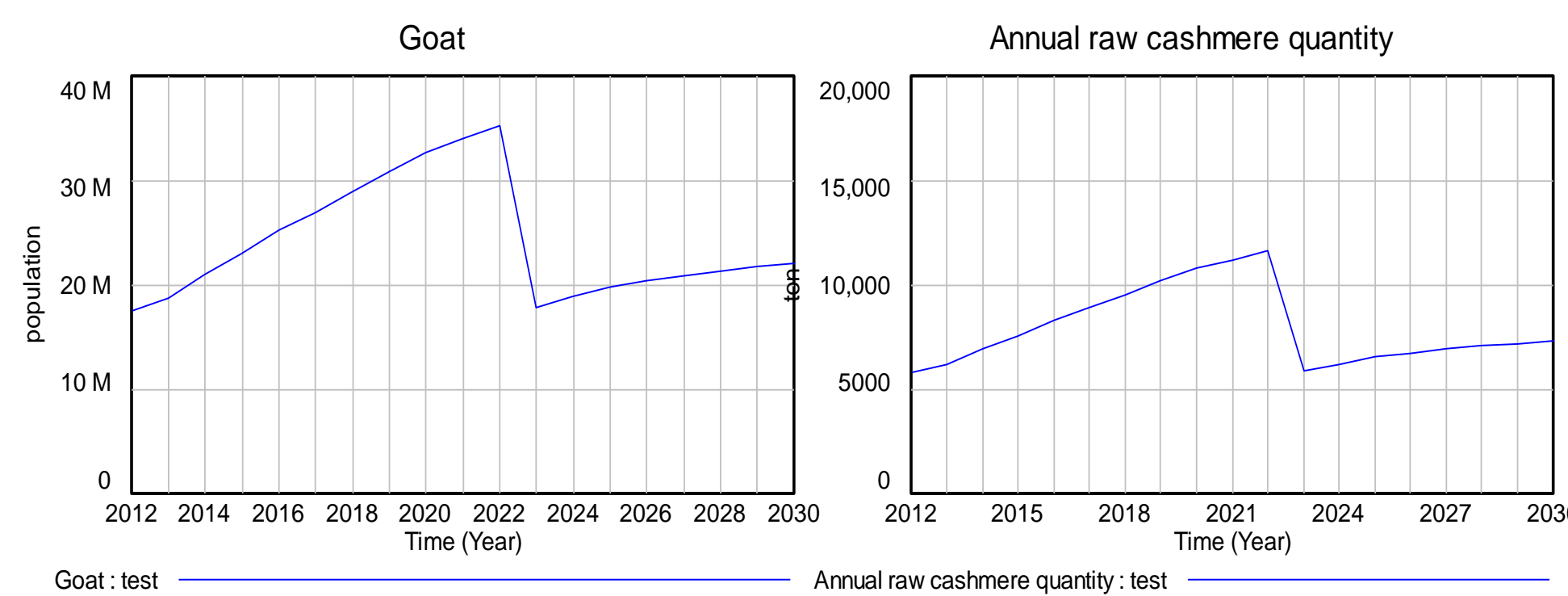

Also in this sector, it is possible to estimate the changes of number of goat and any loss to cashmere sector because of natural disaster. Also there is a prognosis of price of raw cashmere.

The cashmere washing capacity is the highest in Mongolia as a first primary processing. Annual capacity of washing stage is approximately 14000 tons. But some research shows that the washing machines and equipment are getting very old throughout the country. 50% of equipment in washing factories is used for over 10 years; around 25% of equipment was used for 7-9 years. It means that it is necessary to renew all equipment of washing factories. Main factor influenced in equipment aging is that most of equipment imported to Mongolia are already old, they are imported after being used in production for12-14 years. Mostly, old and outworn equipment from China and Japan are imported at low price and used in Mongolia. Therefore, the washing stage is left behind the new technology. [3], [4].

Figure 2. Dynamic Model for cashmere washing stage
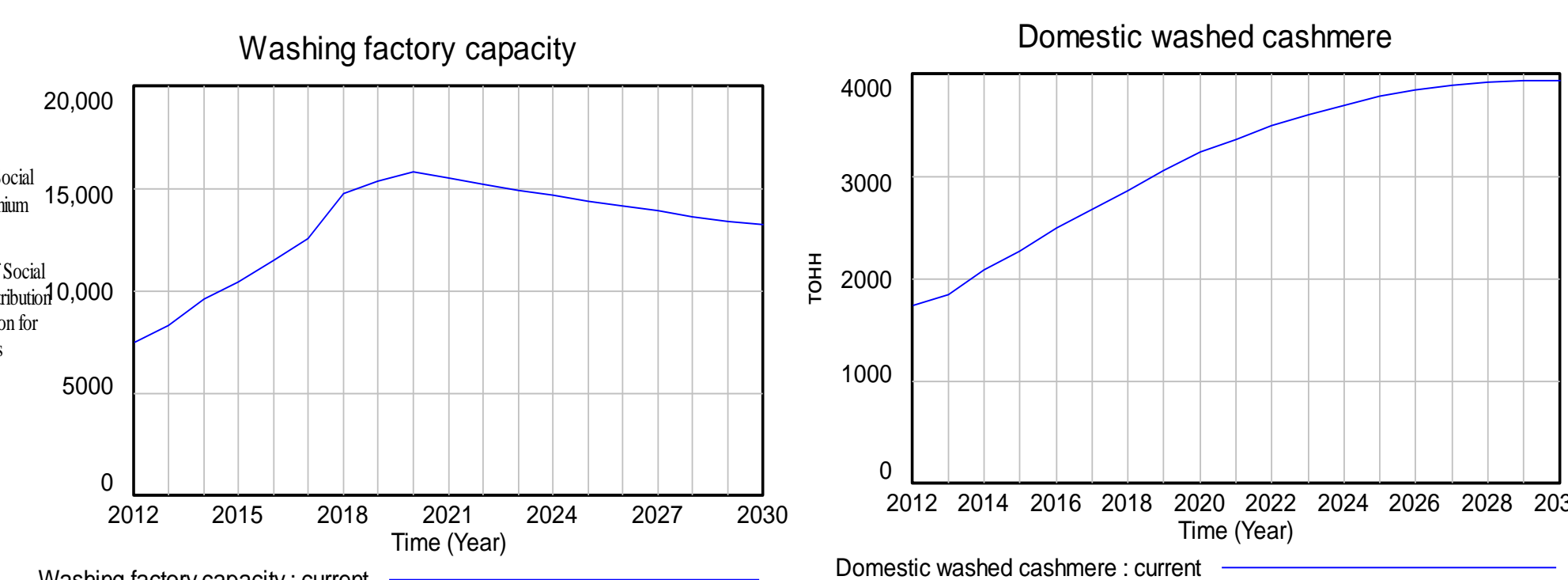
Simulation Results

Export taxation on washed and dehaired/combed cashmere is considered as main variable in the simulation and we demonstrated how it affects the main indicators as shown below.
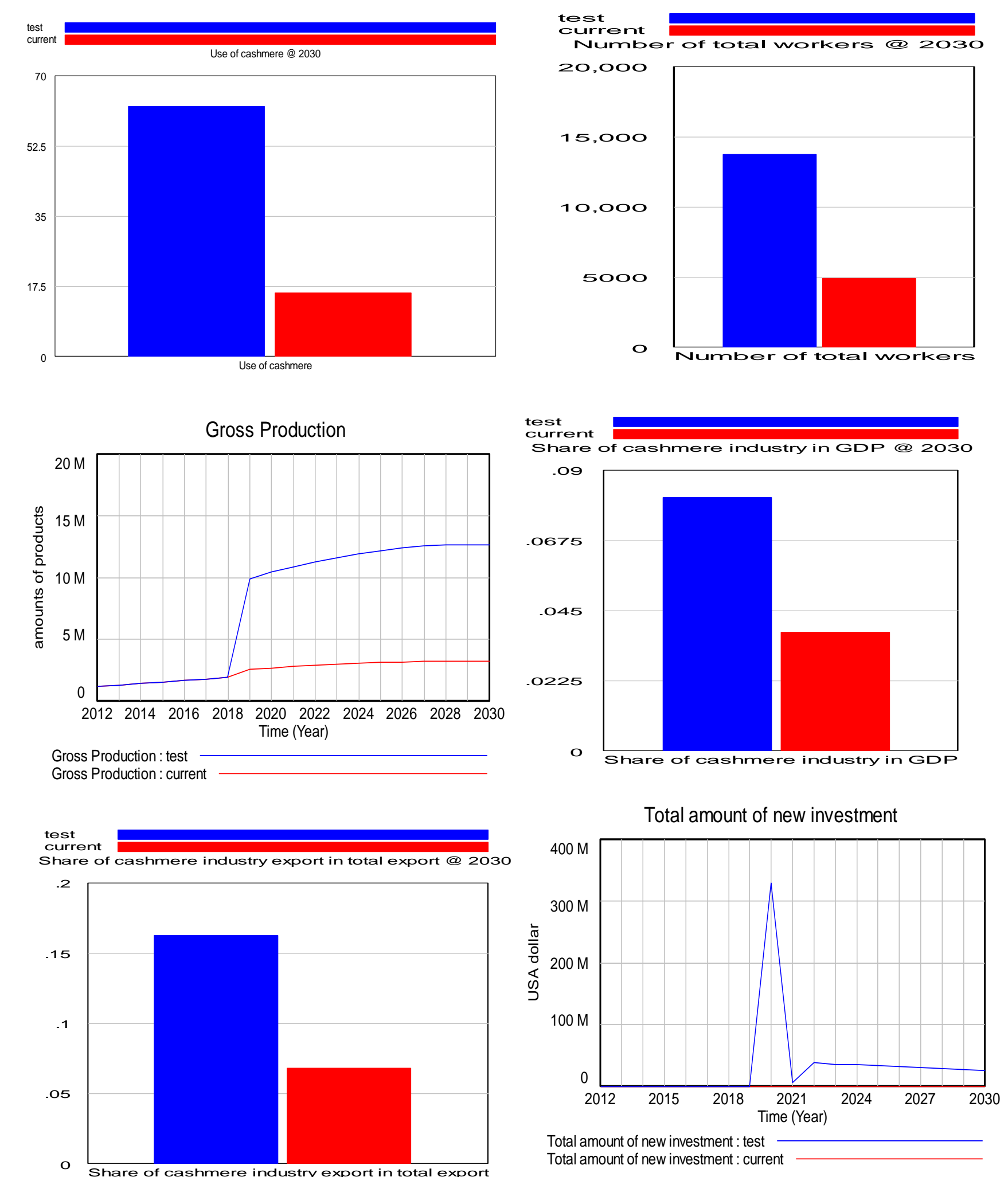
Conclusions and Implications

The "Cashmere Program" by Mongolian government in 2018 intends to increase the country's full processing of cashmere from 16% to 60% within four years [7]. Our simulation shows that this initiative can bring many opportunities and have a positive impact on the social and economic indicators. Increasing the domestic production of cashmere full processing to 60% will double cashmere sector share in the GDP from its current 4% to 8% and increase the share of cashmere export revenue in total exports of Mongolia to up to 16% from 6%. In addition, it will create 9000 new jobs in the labour market, increase total cashmere sector turnover up to 5.27 trillion MNT up from current 2.34 trillion MNT and can accumulate over 1.22 trillion MNT of export taxation revenue in government.

We concluded that the export tariff rate of 20% on washed and dehaired/combed cashmere is most appropriate. Alternatively, if we consider the export tariff rate of 60% on washed cashmere and 12% on dehaired cashmere, the above goal can also be achieved. The models allows us to observe numerous different outcomes and results by changing the export tariff rate in order to increase the full processing of cashmere and increase domestic value-added full production.

Our model also shows how much investment is necessary at each stages of the value chain in order to realize the above goal. The amount of needed investment is estimated to every single conveyer of cashmere processing. According to our research, there is necessity of 308.5 million dollars investment for equipment and construction in order to reach 60% of raw cashmere processing level. Specifically, we conclude that 6.5 million dollars for combing factory, 13.6 million dollars for spinning factory, 59.2 million dollars for knitting factory and 229.2 million dollars.