



# Organizational learning effects in productivity: a dynamic hypothesis proposal for shipyard learning

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## Scope of Work

The purpose of this study is to propose a dynamic hypothesis for shipyard learning. From this hypothesis was developed a system dynamics model that combines **Workforce, Production and Learning** model structures and proposed some guidelines to policy designers in order to promote shipyard learning and competitiveness.

## Learning Curves in Industry

**Pattern of Behaviour** observed in many industrial sectors (1), including shipbuilding (8)(3); Deviations from this pattern were also observed (1) and called as periods of unlearning (2).  
**Learning Curve Properties:** learning curves have two main characteristics, observed as production accumulates experience:  
▪ Increasing productivity to perform the task  
▪ Decreasing rate of productivity increase to perform a task

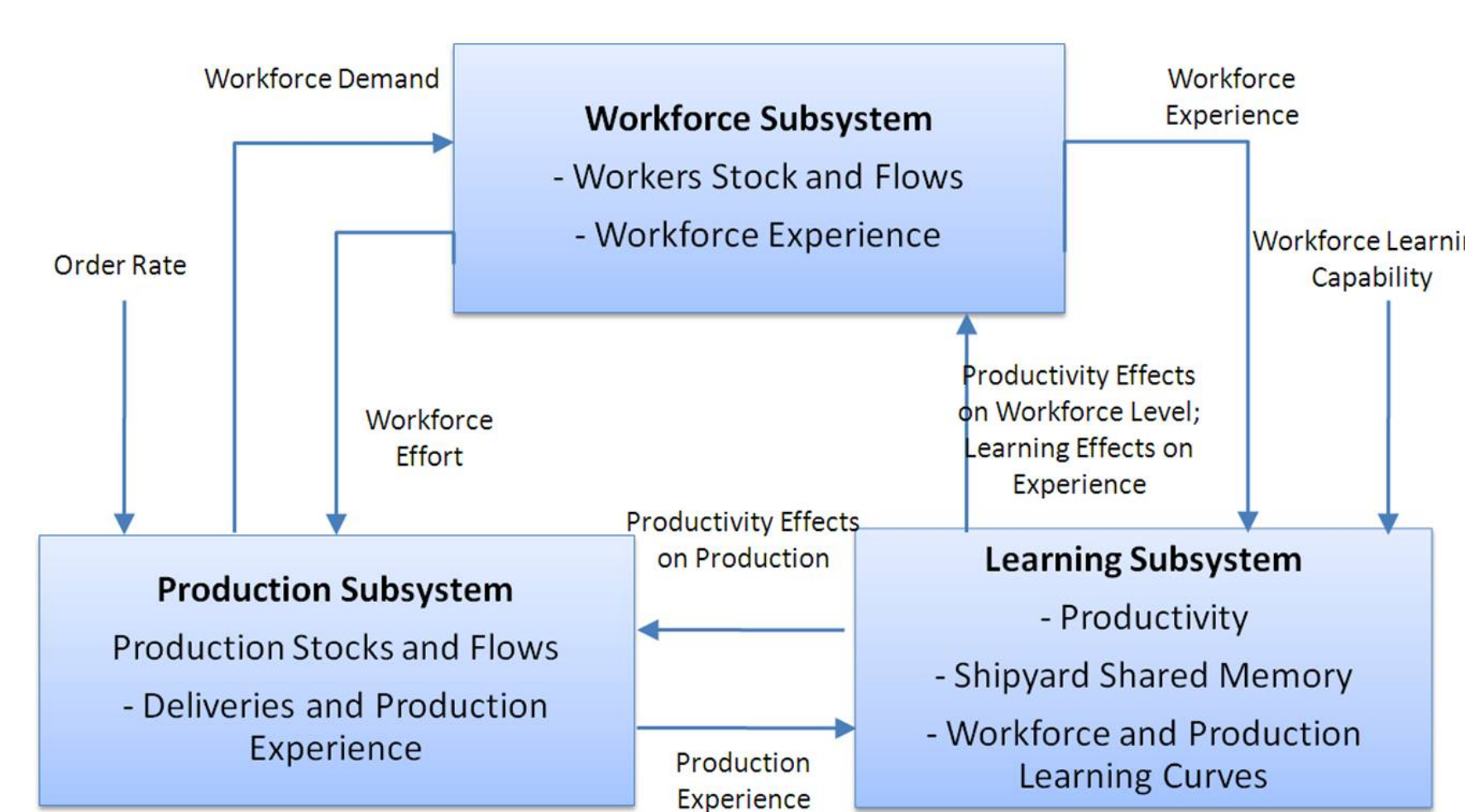
$$L_E = \left( \frac{E_X}{E_0} \right)^{\log_2 (1-F)}$$

$L_E$  = Learning Effect,  $E_X$  = Experience,  $E_0$  = Initial Experience,  $F$  = Intensity of Learning

## Learning Definition, Kim(5) and Senge(9)

- Learning is how to develop skills and capabilities, not just adaptation. (9)
- Learning is how to increase ability to take effective action. (5)
- Is not every experience that generates learning (9)
- People are the source of learning in organizations (5)
- Link of individual learning to organizational learning through shared mental models (5)

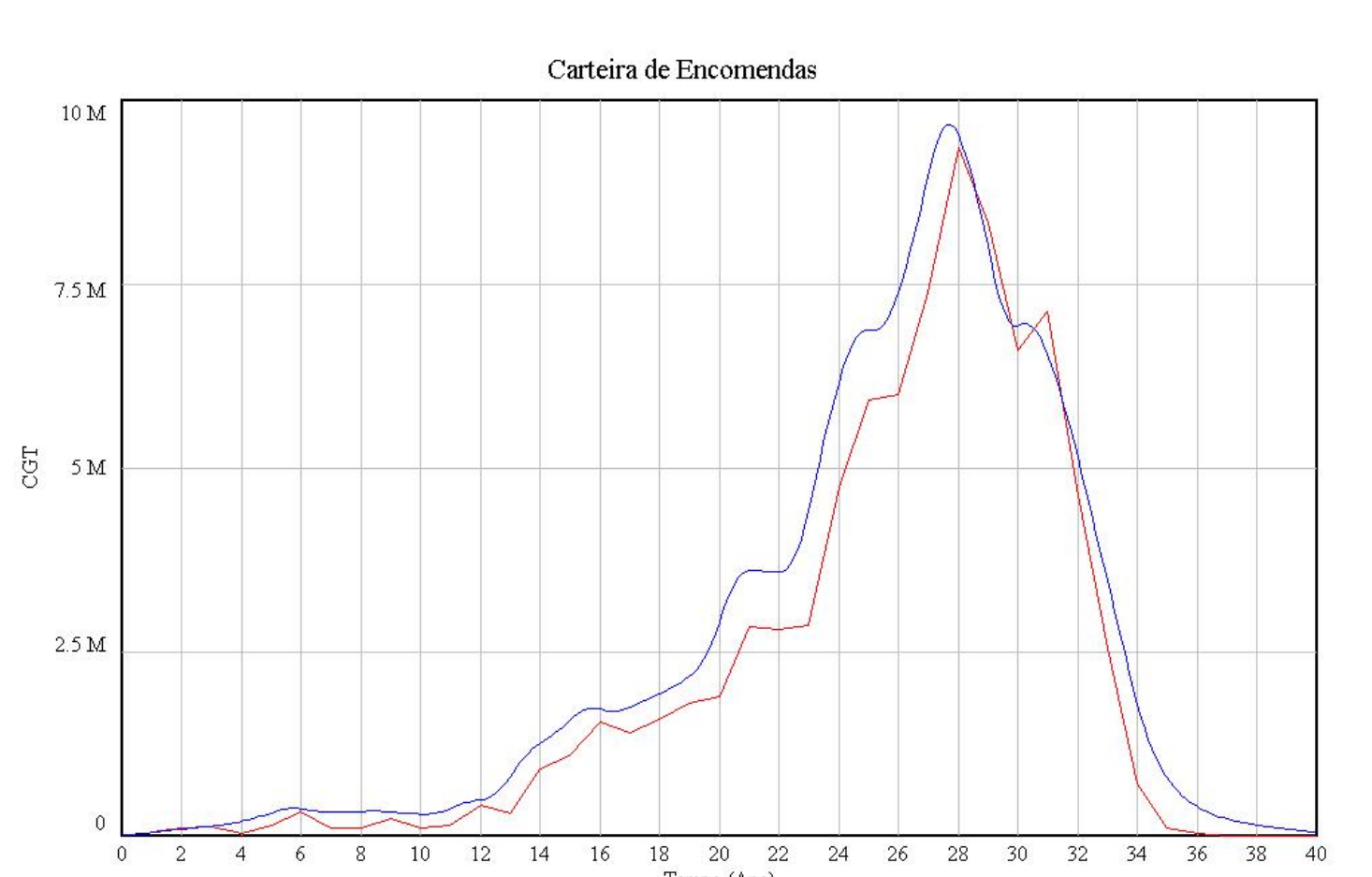
## Subsystem Diagram and Modeling Process



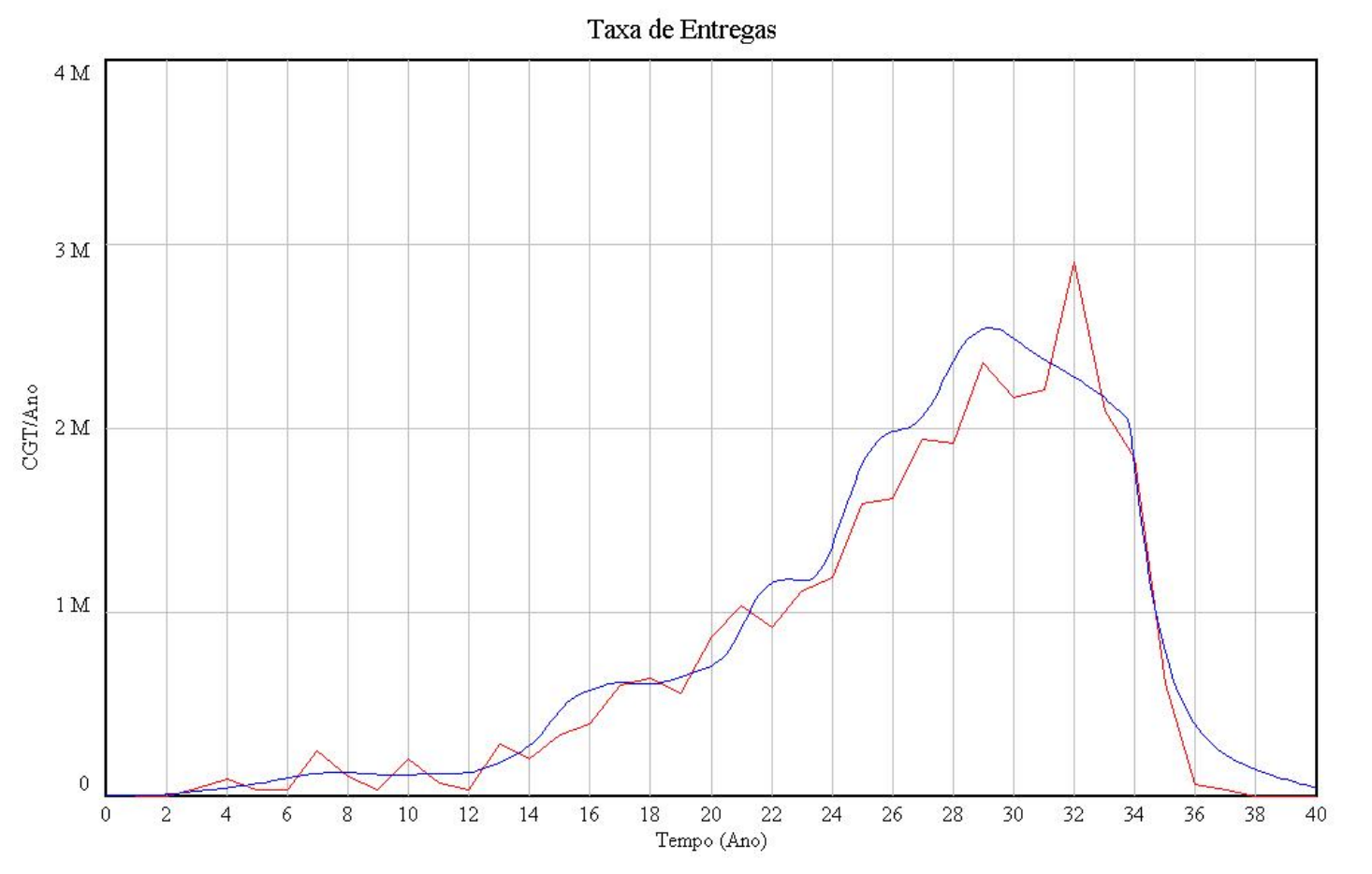
**Five Modelling Interactions:** to formulate this dynamic hypothesis it was necessary to perform 5 cycles of modeling (individual learning cycle). The starting point was Inventory-Workforce model by Sterman (10).

## Results

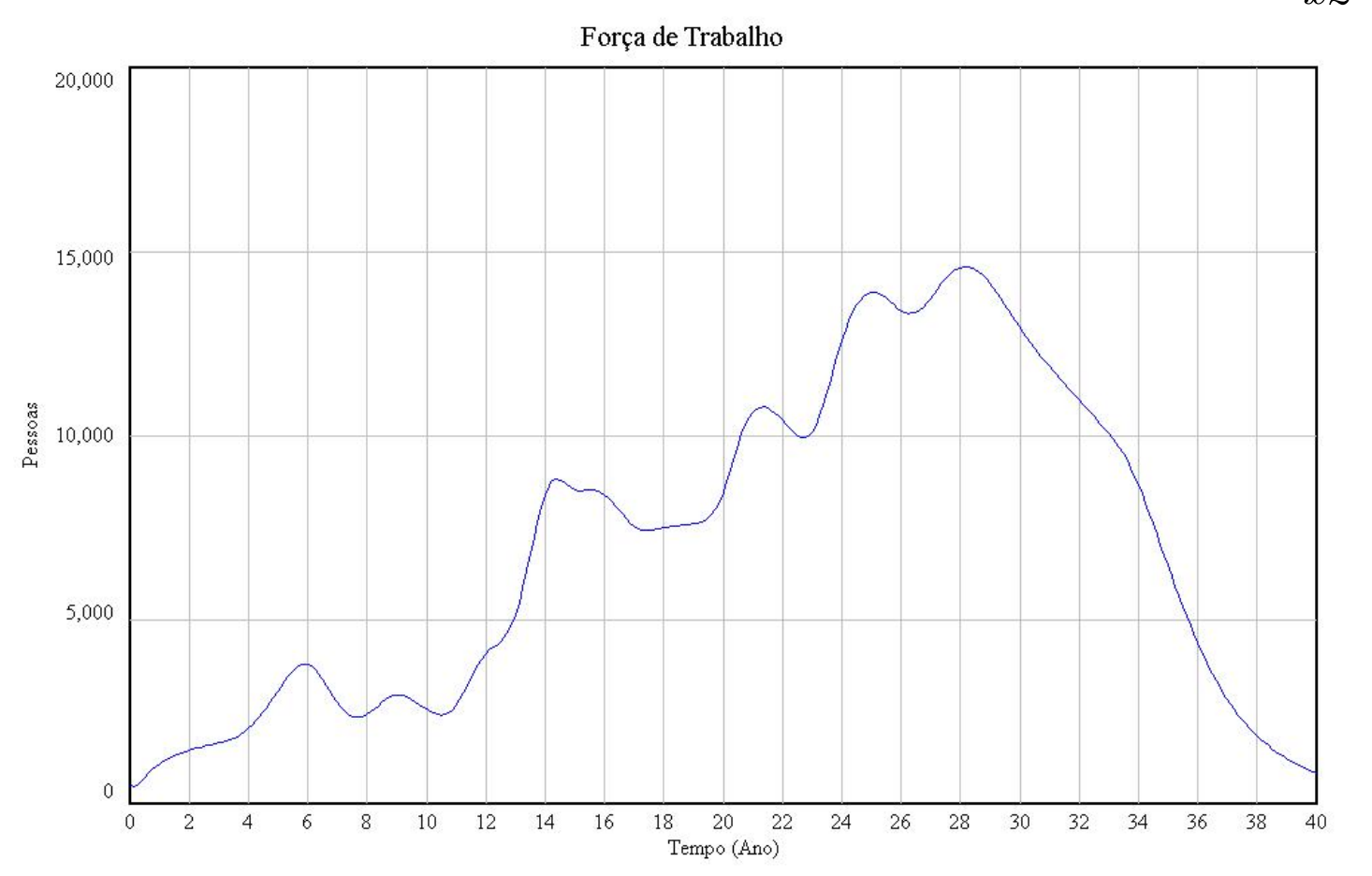
Model behaviour compared to reference mode data (asian shipyard):



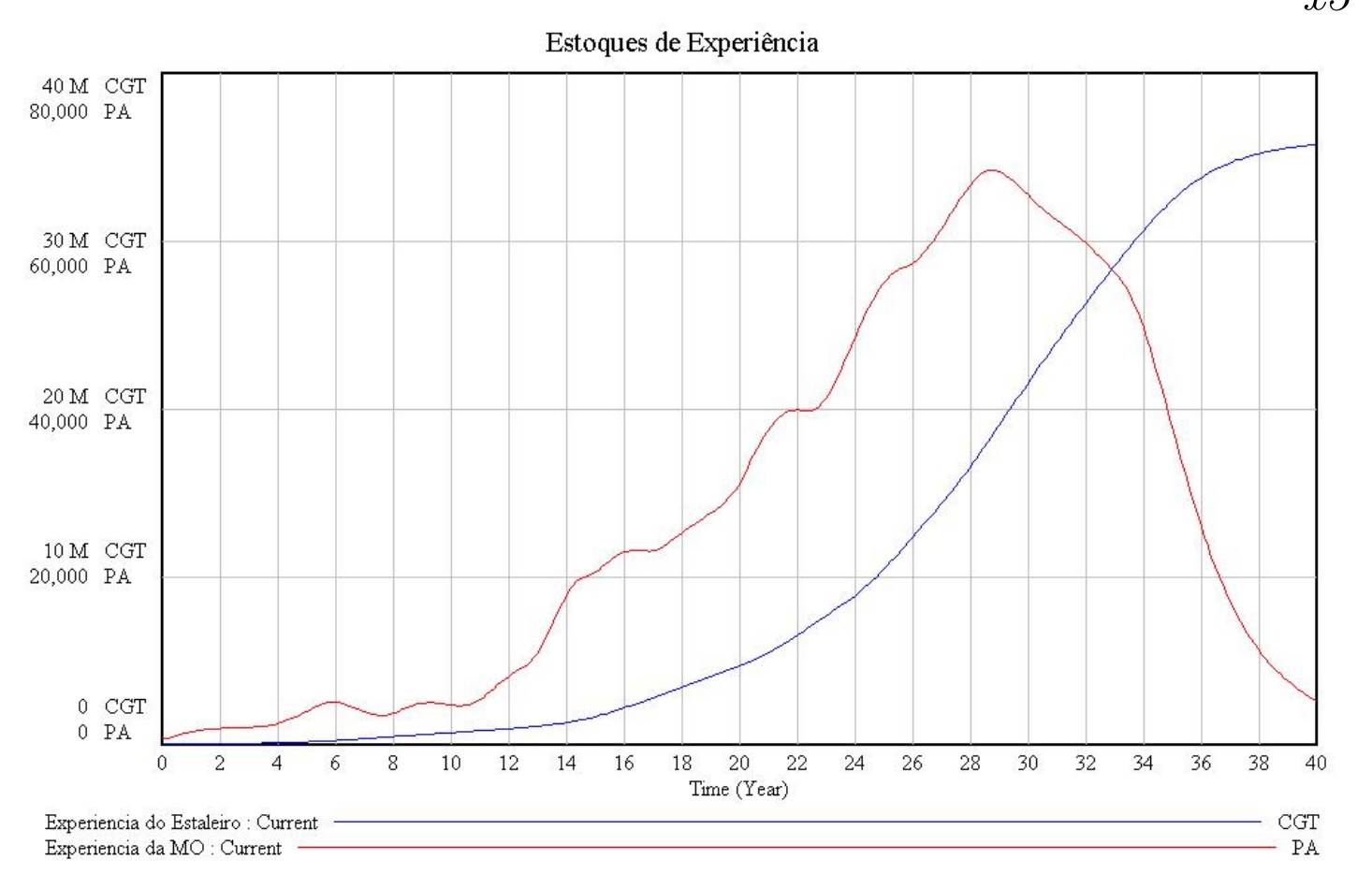
x1



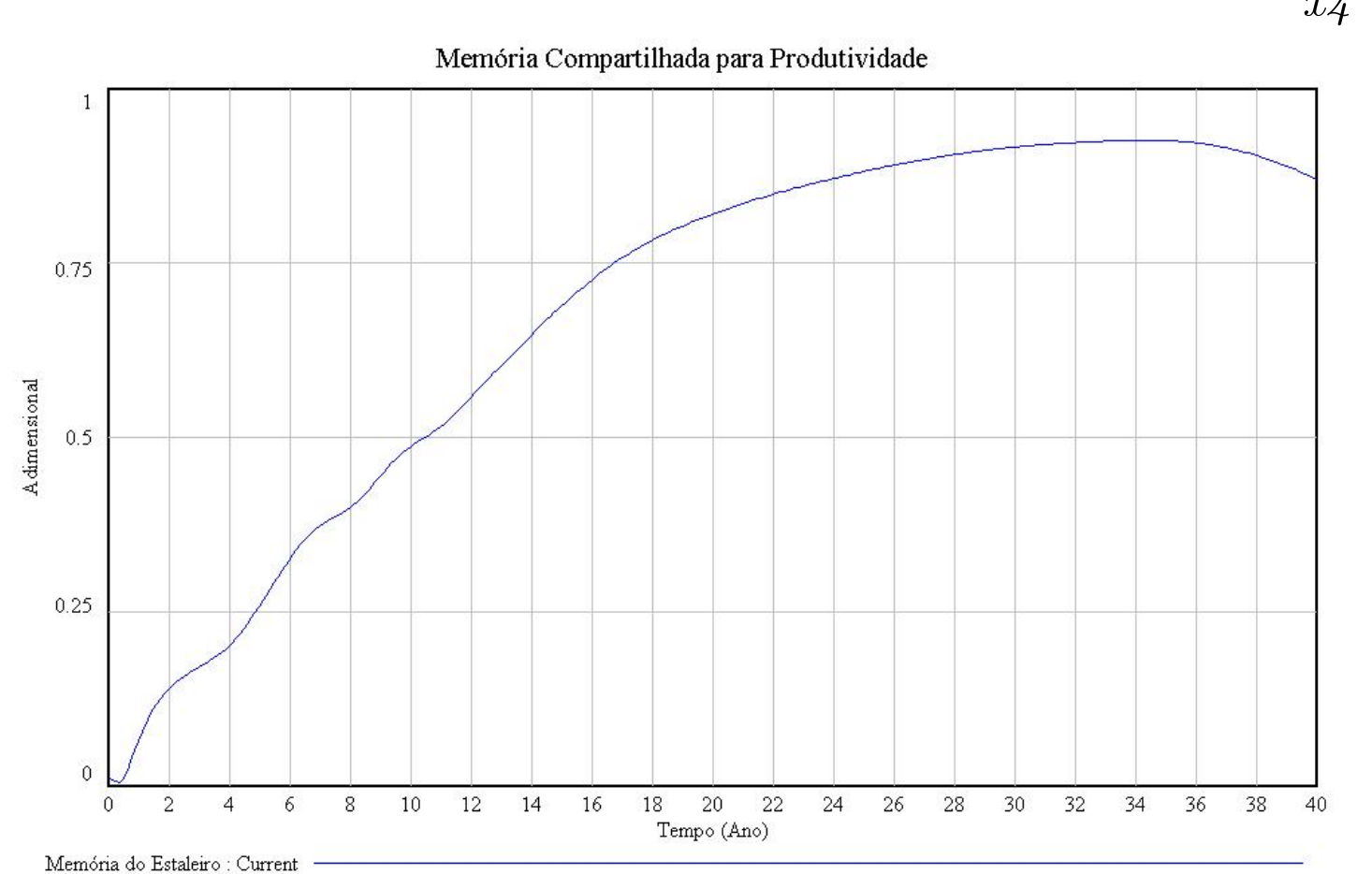
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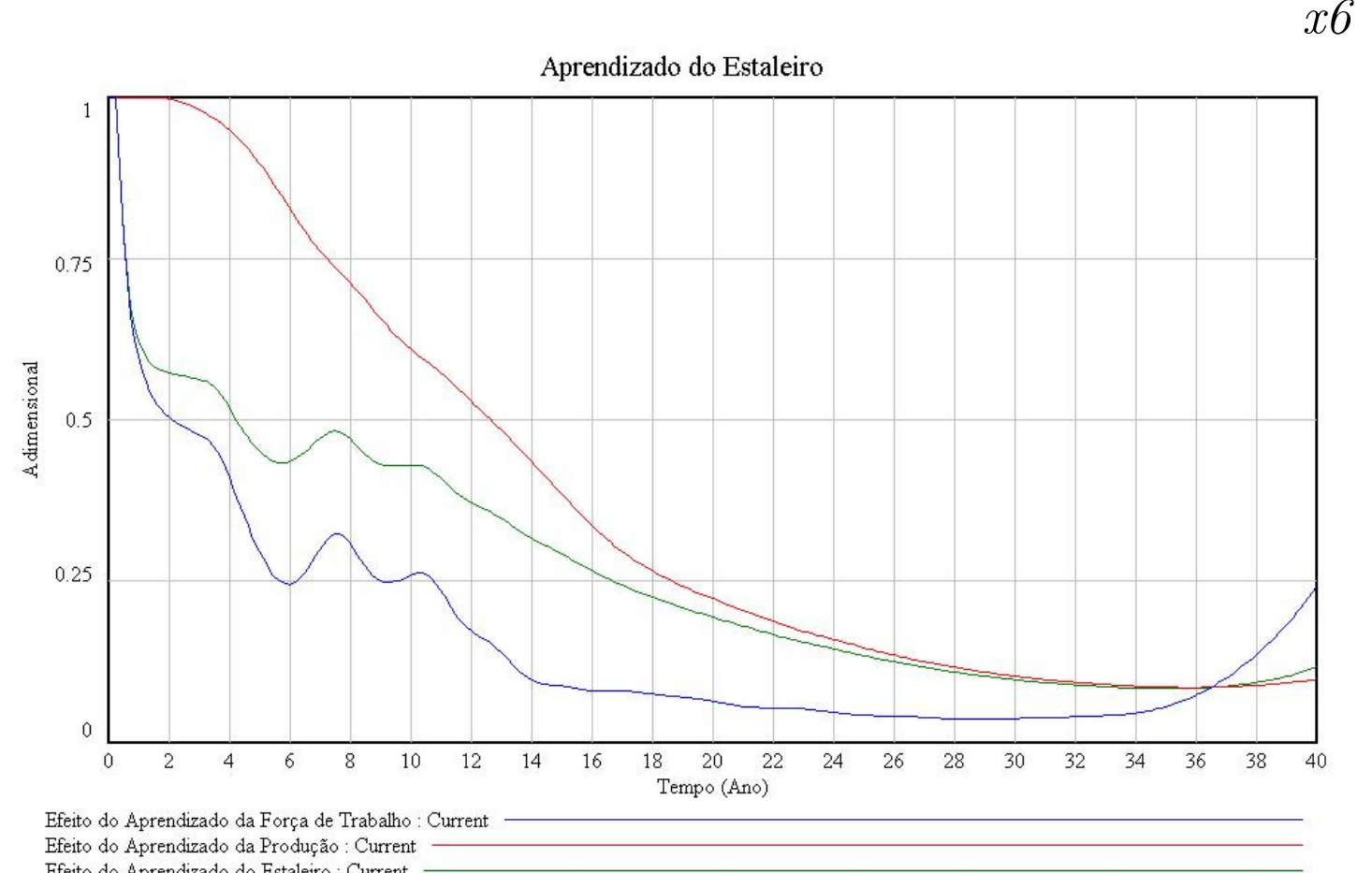
x3



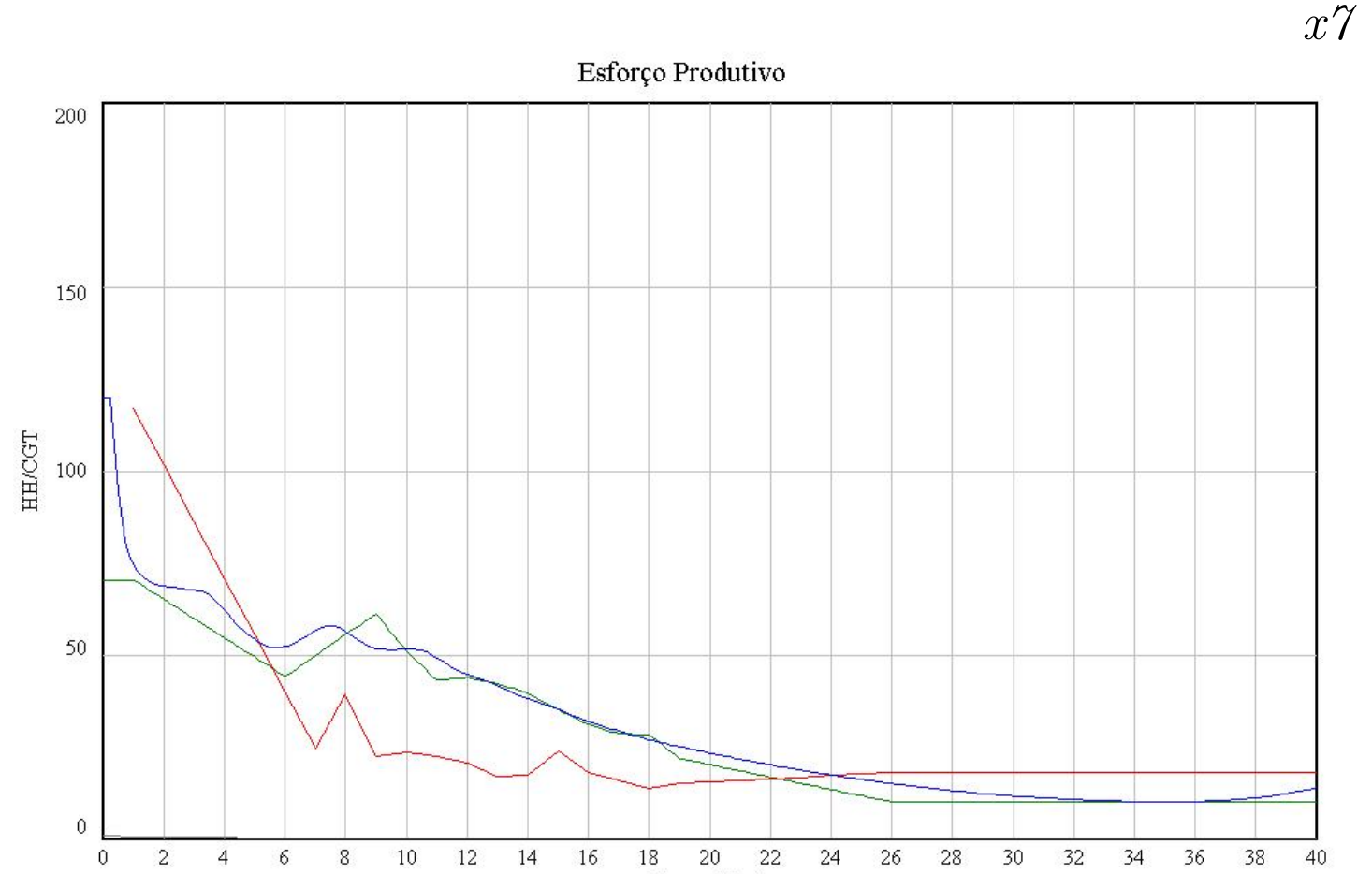
x4



x5

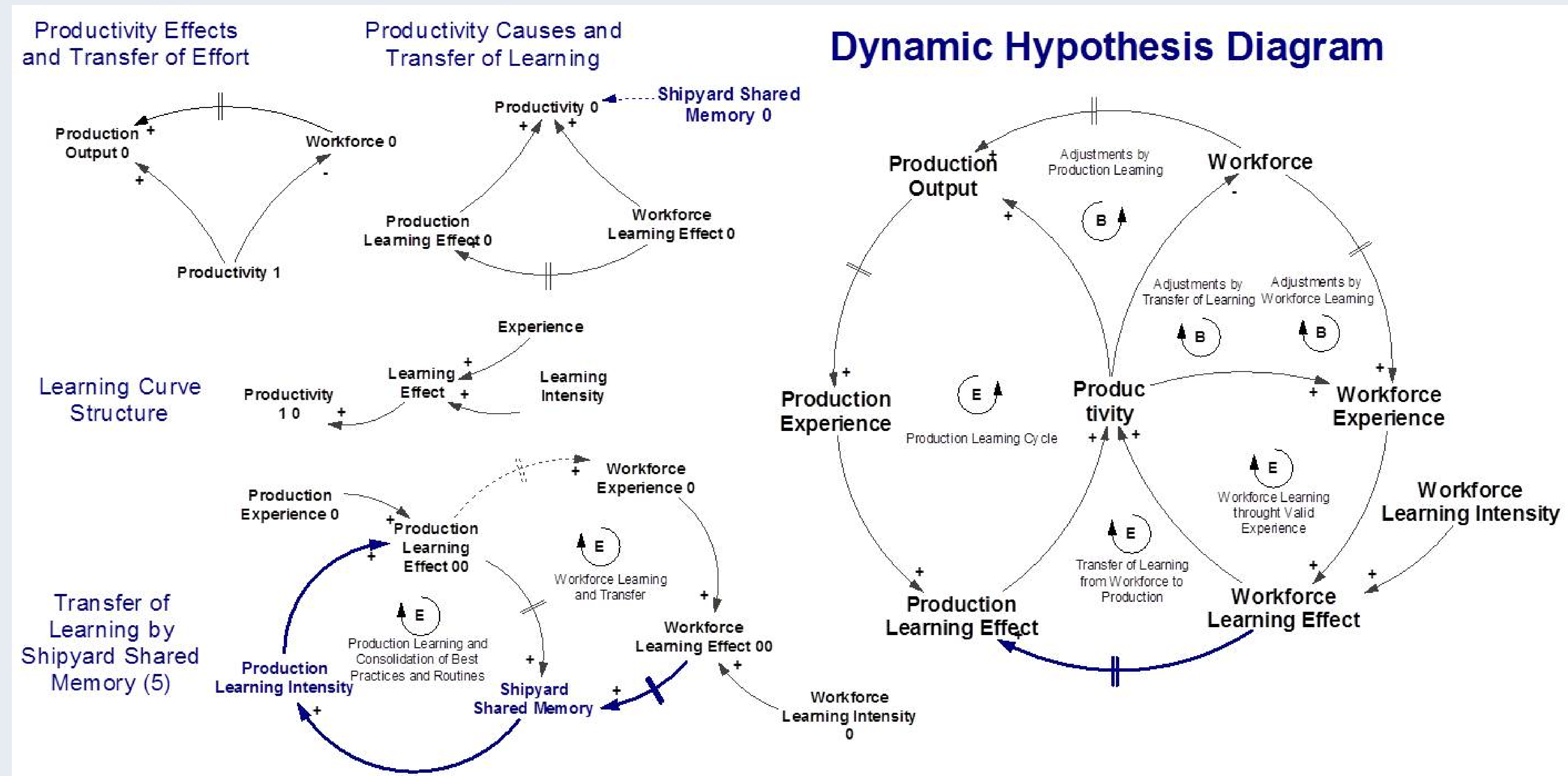


x6



x7

## Dynamic Hypothesis for Organizational Learning in a Shipyard



Dynamic Hypothesis Formulation

## Conclusions

- Suggestions of guidelines to promote shipyard learning
- avoid workforce growth without productivity increase
  - retain workers and preserve workforce experience
  - encourage experience that promotes learning of workers
  - increase workforce learning intensity
  - assure transfer of learning from workforce to organization

**Considerations:** Productivity should not be the only objective of a shipyard. Resilience should not be sacrificed. (7)

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