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Surviving Budget Cuts in Higher Education: A System Dynamics Approach to Model Long-term Impacts

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1. Introduction

The reduction in government funding poses a significant number of challenges to the financial systems operating for post-secondary educational institutes. These budget cuts can lead to adverse effects such as budget constraints, limitations on resource allocation, and potential impacts on overall academic quality. Post-secondary institutes to rethink their financial systems and strategies to effectively navigate the consequences of these funding reductions which entails the implementation of certain measures to optimize their system to strike a balance between financial resources, streamlining of operations and creating new revenue streams, all with maintaining their overall academic quality and fulfill their duty of education at the highest standard of excellence.

While the focus of previous studies was not on the effects of budget cuts on enrollment, tuition, infrastructure gaps, and education spending, it is important to investigate these aspects to make more informed decisions and responses both by university administrations and investigate the long-term impact for policymakers. In this paper, we particularly focus on the challenges that Universities across Canada faced with navigating reductions in several provincial governmental funding, issues stemming from tuition fee caps, and complexities surrounding admissions of international students. Our goal is to study the long-term implications that balance financial independence and overall quality of education.

Three strategies to respond to funding cuts by postsecondary institutions are discussed in detail:

1. Reduction in operational expenses
2. Increasing enrollment
3. Increasing tuition whilst keeping enrollment steady

2. Methodology

2.1. Dynamic Hypothesis and Causal Loop Diagram

The causal loop diagram describes the complex behaviour of budget adjustment when a funding gap arises in the annual operating budget of a university. The base structure of the causal loop diagram consists of four balancing loops. Each loop is representative of a strategy pathway that may be pursued to reduce the funding gap. This is shown in Figure 1. It is assumed that revenue is comprised of tuition revenue, government funding, and private funding, and that expenses are limited to infrastructure and educational costs.

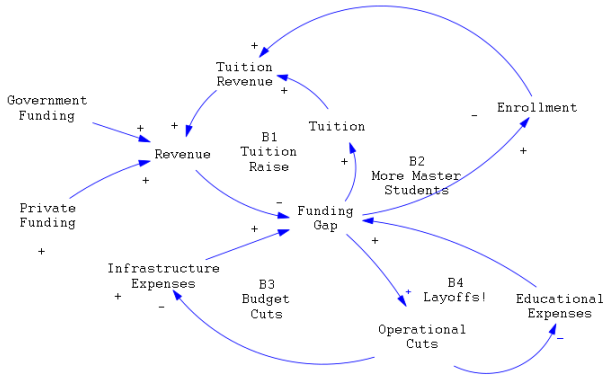

Fig. 1. Causal loop diagram for the initial problem and strategies to respond

The remaining additions to the cause loop describe the system archetype of fixes that fail with unintended effects of all pathways described, introducing reinforcing loops that counters the effects of the four main balancing loops as shown in Figure 2.

Notably, there is only one exogenous variable, being “Government Funding”. This is consistent with the hypothesis that a change in government funding will trigger a response from the system.

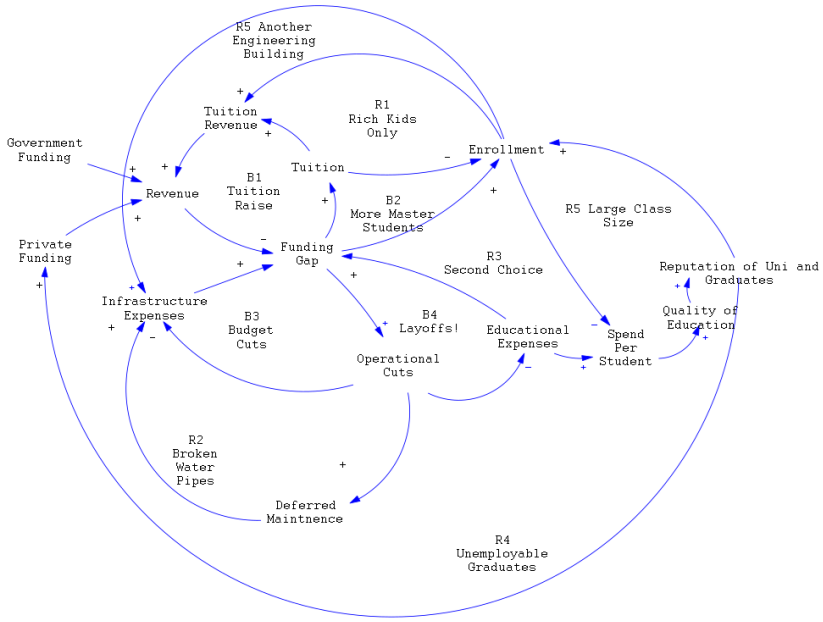

Fig. 2. Causal loop diagram of the complete model including 10 loops and “government funding” as the exogenous variable

2.2. Stock and Flow Diagram and Simulation Model

A stock and flow model is developed for simulation purposes. It is built off four stock-and-flow variables, each of which describe one of the adjustment pathways discussed in the causal loop

diagram. Again, the core of the model is the funding gap, which triggers rate variables for each stock. If the funding gap is zero, the stocks will stay static. If the funding gap is greater than zero, the model will trigger. The four adjustment pathways and their corresponding rate variables will respond by a specified percent correction of the total funding gap, allowing the funding gap to zero out exclusive the unintended consequences. If the funding gap is less than zero (representative of a surplus), that funding will disappear from the model and will not influence the change of any variables. State variables represent variables that change year-to-year based off the stocks.

3. Results and Discussion

There were seven scenarios simulated using the stock and flow diagram in Vensim. These scenarios are supposed to represent various policy choices and political outcomes that are possible. These scenarios are described in more detail below:

1. Government reduces funding once and keeps it stable
2. Government stays in power and keeps reducing funding
3. Change in government after 8 years and funding is restored
4. Government reduces funding while also freezes tuition fees increase
5. Quality of graduates from other Universities goes up
6. Government stays in power and continues to drastically cut funding until there is no public funding to the university.

The key findings and observations from the modeling efforts are:

1. There is a decrease in enrollment for all scenarios in the long term given quality of education is negatively affected despite initial increase in enrollments (Assuming total demand for higher education in the county is constant)
2. Even when government funding is restored to its initial levels after some years, the trend in reduced enrollment does not significantly change due to the system memory and its structure.
3. Tuition fee seems to stabilize in all cases except scenario 6 and when allowed to change.
4. A push towards privatization results in a significant increase in tuition fees and a decline in the quality of the institution.

4. Conclusion

This paper presented a common challenge that many postsecondary institutions are currently facing with major reduction in support from federal or provincial government. The system structure indicated fixes that fail archetypes and several reinforcing and balancing feedback loops work together to impact operational expenses, tuition, and education quality. The model shows that any budget cuts to the university result in a decline in the quality of graduates, increasing enrolment and increasing tuition.

The main takeaway from the analysis in this paper is that funding cuts to higher education, especially when suddenly implemented, may result in permanent impacts to the quality and consequently the enrollment in the long term – even if the funding cut is restored in later years. University administrations should also be more carefully respond to these cuts and avoid short-term solutions (such as aggressive increase in enrollments) that may result to a more severe

challenge in the long-term . As such, postsecondary institutes after lobbying with the government to minimize the amount of sudden budget cuts as much as possible, should explore more innovative and internal solutions despite they may take longer or be more difficult to address compared with short term solutions to avoid addiction archetypes such as strong dependence on number of international student and the revenue from those tuition fees. The decline in quality due to high enrollment and lower education standards may not only affect the institution's perceived reputation and future enrollments but could also further justify government budget cuts or result in the loss of investments, donations, and philanthropic support from third parties.

5. Acknowledgements

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