COUNCIL VERSUS FACULTY:

WHAT LOWERS SUPPORT OF STUDENT ORGANIZATIONS IN A UNIVERSITY?

UNIVERSITY OF BERGEN

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Modelling project report

GEO-SD304 System Dynamics Modelling Process

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INTRODUCTION

Student organizations offer opportunities for leadership development, increased self-esteem, and life skills for students, and serve as a space for volunteering [1], [2], [3]. In my personal experience as a member of the Student Parliament (SP) of Riga Technical university (RTU) I have witnessed my "soft skills" increase. However, the SP faces constant backlash from different parts of the university ecosystem depending on how they present themselves, which is also a problem seen in other student councils [4]. During my time as a member of the organization, I mostly noticed a decline in support from the administration of the university. Since the administration has great influence in dictating how the SP operates, it is worrisome to think that they might continue lowering support to the organization that has given valuable life experiences to so many students, and in which I myself have invested much time and energy into. This is what is puzzling – how can the faculty not support an organization that does so much good to its own students? Research states that universities clearly benefit from student organizations [5]. I hope to uncover the underlying structure that causes internal mistrust of the SP from the administration, and how that affects the SP in return.

Figure 1 and the remaining chapter explains reference mode of behavior, which is supported by my own experiences as a SP member for 5 years and by those of colleagues I've corroborated it with:

"What drew me to the SP was an incredible social project, a camp. As my studies began, I immediately signed up to be a member so I could try my hand in project organization. However, it took 6 months before I could call myself a member, as I was still learning the ropes at first.

Afterward, I actively participated in project organization. As I got to realize more social projects, I found myself drawn less to my studies and formal education and more drawn to what the SP could offer – hands-on experience in management. Of course, spending most of my time in the SP led my performance in academics to drop, which led me to focus back on my studies more, but that usually cleared up in a matter of a few months.

The more social projects we organized, the more I started hearing from my colleagues that the administration is cracking down on support by not raising the budget of the SP and putting up other hurdles. The SP had fallen off of their good graces. We wondered why this could be, and we saw that over the next few months, activity among most members started to fall off, as they became less interested in working on projects seeing as the SP wasn't allowed to do much outside of what they usually did. This stunted progress and lowered the interest of the members.

We had a meeting with the administration to see how the problem could be solved, and they referenced that the SP was underperforming in their eyes, even though we thought the organization had been flourishing with all of the social projects we were organizing. As it turns out, the administration wanted the SP to focus more on academic projects, such as motivation for students to get into science and more, to increase the prestige of the university. We complied and shifted our priorities to creating more academic projects. These were much more time consuming, but the administration were happy with them, and they became more and more supportive over time. As their support increased, we allowed ourselves to use it for larger social projects to take a creative break from the more technical work that academic projects demand. This brought in more students to the SP and raised interest again. However, the administration saw the SP return to its old ways and began decreasing support again.

As the years went on, this cycle continued in a seemingly downward direction, as support fell more and more. It seems as if the administration had gotten more demanding of the SP over the years, leading to increased expected results, decreased support and decreased capacity, which leads to even less work being done."

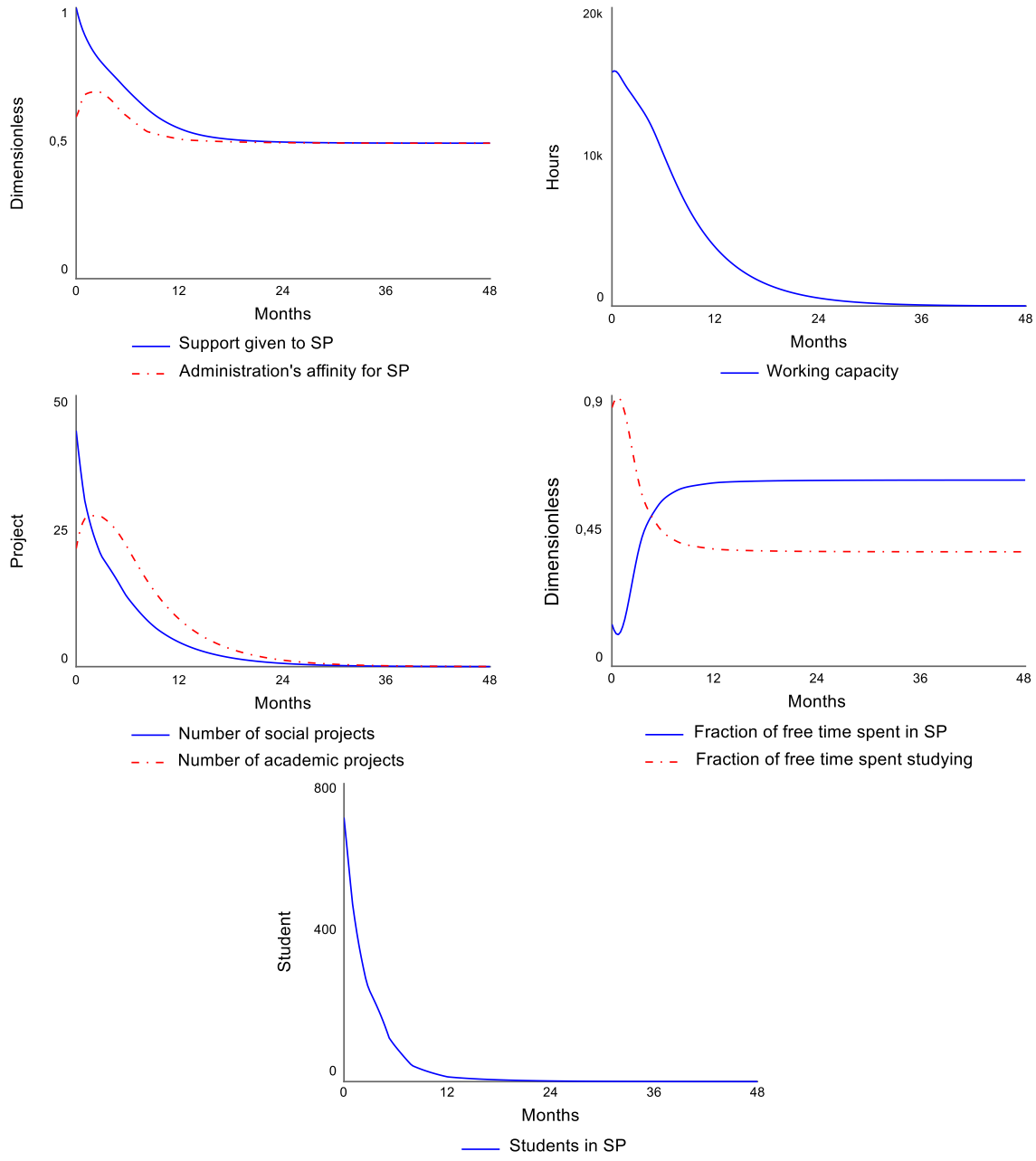


Figure 1 – Reference modes of behavior (in order from left to right, top to bottom: support and affinity for SP, working capacity of the SP, organized projects, free time allocation, students in SP.

MODEL DESCRIPTION

The dynamic hypothesis explains some of the structure that creates the problem described in the reference mode. There is no known previous or ongoing work that explores the dynamic behavior of student organizations and administration, therefor, the model which follows is based off of personal experience and an interview conducted with the current president of the SP, including necessary assumptions, as well as useful data offered by the RTU [6]. The model has been calibrated to begin 1 year before the present-day situation to observe how continued behavior will affect the SP.

The main assumptions in the model come in the form of parameters which are exogenous, such as expected projects and adjustment times, as these values are subject to change based on the systems that are outside the scope of this model, as well as are not readily known to any party, as they are largely subconscious and abstract. The model boundary diagram is shown in Table 1.

Table 1 – Model boundary table.

Endogenous	Exogenous	Not included
SP member saturation and shortfall	Normal fraction of students in SP	Support for other university sectors
Working capacity	Study time needed for normal grades	Students enrolling and graduating
Free time allocation	Normal grades	Competence of SP members
Project prioritization	Adjustment times	SP member satisfaction
Average grades	Effort needed for projects	University student happiness
Students in SP	Expected projects	SP's of other universities
SP activity	Optimal students in SP	Public image of the RTU
Support given to SP		

Figure 2 shows a hybrid causal loop – stock & flow diagram of the model. The remaining chapter explores the stories of the main feedback loops that appear in the diagram. A full behavioral explanation of each feedback loop can be found in the model can be found in appendices A and B.

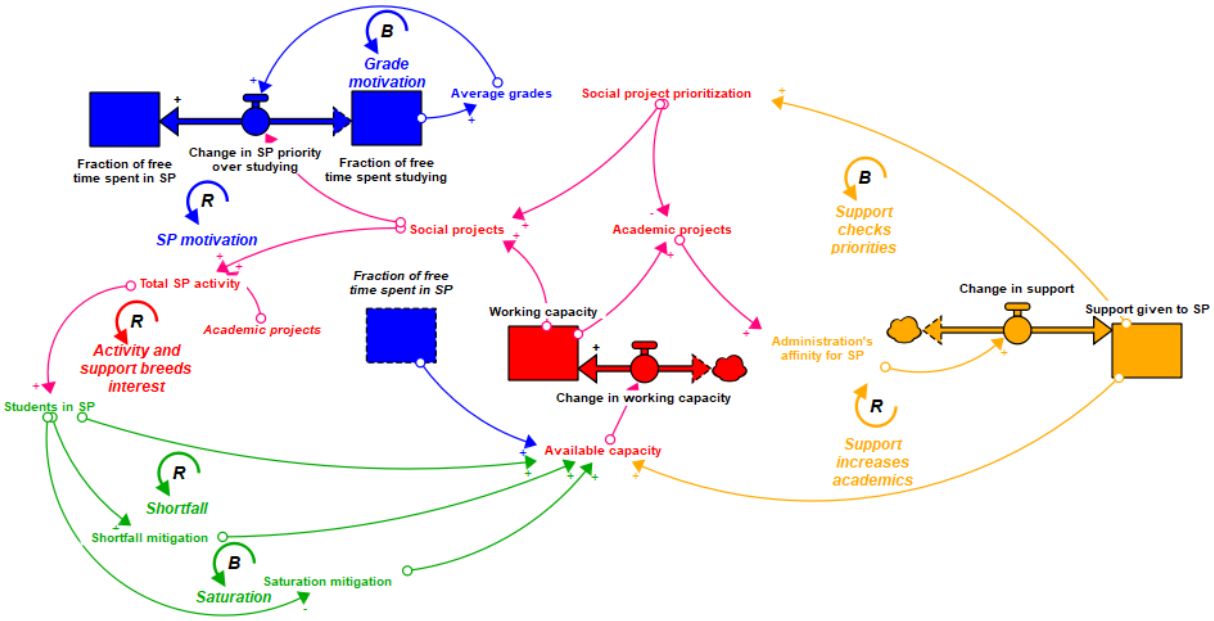


Figure 2 – Hybrid CLD – SFD of the model.

Grade motivation – This loop explains the behavior observed in many students that are members of the SP when balancing their free time. Generally, SP members prefer to spend their time working in

the SP, only studying enough to keep up their grades to passable levels. As they spend less time studying, their grades drop, which causes them to realize that they should study more (since being expelled would also mean not being able to participate in the SP, which is an implied desire).

SP motivation – The SP motivates its members by creating social projects, such as team building and leadership events. The more social projects are realized, the more members want to prioritize the SP over their studies. As members devote more time to the SP, the capacity of the SP increases, since people are putting in more hours working on projects. This allows for even more projects to be created, closing the loop. However, this reinforcing loop also acts in reverse – if students are not motivated enough with social projects to spend as much time in the SP as they would normally, they change their priorities to studying instead, not finding the SP engaging enough. This leads to a lower working capacity and, eventually, even less projects.

Activity and support breeds interest - The SP gains members by upholding standards in its activity. It doesn't matter what projects they prioritize, just that the total activity stays up [7]. Academic projects also serve to increase support for the SP, which is a key for increased activity. Once SP activity increases, the SP becomes more noticed in the university and new students form an interest to join as members. New members increase the capacity of the SP after they go through training. With an increased capacity, new projects can be created. But as all reinforcing loops, this one can act in reverse, lowering interest in the SP as it loses activity, which decreases activity even further.

Support checks priorities – More students prefer social projects since they are quicker to realize and offer more creative freedom. If the SP produces fewer academic projects, expectation of the administration are not met and their affinity decreases, but only to a point, below which they cannot be any more disapproving of the SP, as every university lawfully needs a SP. After some time observing whether or not the SP is just having a bad month due to outside forces or is intentionally lowering effort in academic projects, support is decreased. The SP takes notice and begins prioritizing academic projects more in order to not lose the trust of the administration. After they build back their rapport, the SP moves back to their favored type of projects - social, since they are not scrutinized as much by the administration and can afford to relax.

Support increases academics – This loop can describe how the administration expects the SP to act. As support increases, the capacity of the SP increases, which allows them to create more academic projects, which can closer meet or exceed the needs of the administration. In reality, this loop more often acts in reverse – academic project expectations are not met, which decreases support, decreasing capacity, which again lowers how many projects can even be created.

Shortfall – After speaking with the SP president, she informed me that there is an optimal number of students in the SP (around 600). If students stop joining the SP (see "Activity and support breeds interest" loop), then a shortfall issue can occur if the number of active students is below the optimal. There are jobs in the SP that need doing no matter the amount of activity it has, they include writing and filing expense reports and other administrative processes. With an optimal member amount, these jobs can be done without sacrificing project organization effort. If the member count falls under the optimal, these jobs have to be picked up by the same people organizing projects, which leads to their divided attention being less effective in both spots. This can lead to a collapse where less work is being done, meaning less students join, meaning even less work can be done. Luckily, other parts of the system can pick up if this happens.

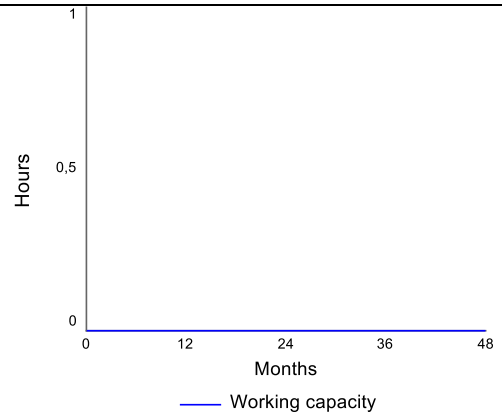
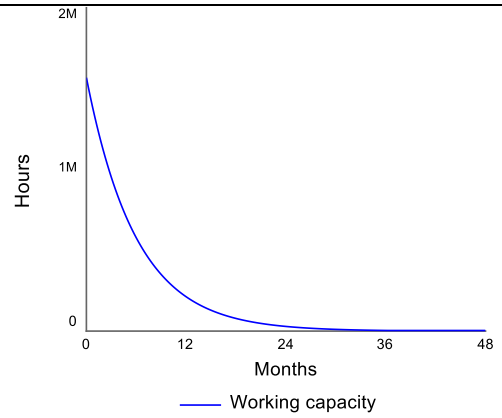
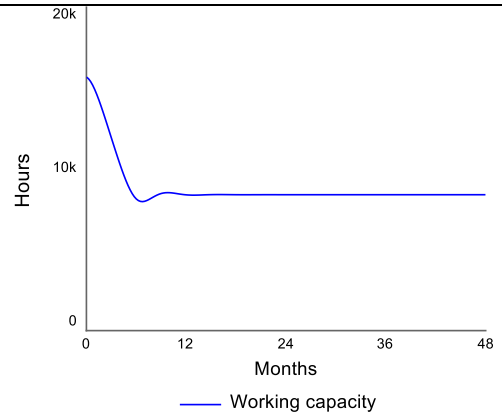
Saturation – A similar process as in the last loop – if member count reaches over the optimal, a saturation issue occurs. There are too many people in the organization and not enough jobs for everyone to do. This leads to problems such as duplicate work being done, members growing uncomfortable with the amount of people and limits to meeting spaces forcing some newcomers to just plainly being rejected from participating.

VALIDATION

To build confidence in the model, several tests were conducted for validation [8]. The direct structure of the model was accepted after multiple rounds of iteration, consultation, my own experiences, and approval from answers to interview questions with the SP president. The model visual structure and documentation can be found in appendices A and B [9]. Parameters and their values and equations were tested against alternatives and were found to be the most appropriate for describing the structure of the real-life system.

Indirect structure tests displayed a range of results. Beginning with extreme conditions testing, refer to Table 2 for results when comparing different values and how they affect working capacity.

Table 2 – Extreme conditions test results

Extreme condition	Working capacity effect	Conclusions
0 students in university or 0 normal fraction of active students in SP		Passed – no students in the university would naturally mean that no students can be a part of the SP.
1,000,000 students in university or 1 normal fraction of active students in SP		Passed – that large of a student base approaching the SP would cause extreme saturation, causing available capacity to be unusable until the SP popularity falls to levels where only a tiny fraction wishes to participate, which would leave the capacity at a very small amount.
Only 1 expected academic project		Passed – if administration had that little expectations of the SP, their support would instantly increase, which would lead to a higher capacity and would allow for the SP to primarily create social projects. However, this would cause saturation issues, limiting to how high the capacity would be able to grow.

Further extreme conditions testing yielded similarly realistic results. For a full sensitivity analysis documentation, refer to appendix C and to table 3 for a summary.

Table 3 – Sensitivity testing result summary

Model Sector	Parameter	Range	Sensitivity
Free time distribution	Priority adjustment time	1 – 6	Numerical
	Hours spent studying needed for average grades	0,25 – 1	Numerical
	Normal average grades	0 – 10	-
SP project realization	Normal effort for one social project	90 - 360	Numerical
	Normal effort for one academic project	180 - 720	Behavioral
	Disposable hours per month	56 - 336	Behavioral
	Capacity adjustment time	1 - 12	Numerical
	Expected social projects	12 - 48	Numerical
Administration support	Expected academic projects	20 - 80	Behavioral
	Support adjustment time	1 – 12	Numerical
Students joining SP	Normal SP activity	1 - 4	Behavioral
	Number of students	5000 - 20000	Behavioral
	Normal fraction of active students in SP	0,025 – 0,1	Behavioral
	Optimal students in SP	400 – 800	Behavioral

Generally, it seems that the model is most sensitive within the students joining SP sector, as all of the tested parameters there exhibit behavioral sensitivity. The remaining sensitive parameters are located in the other sectors, except for free time distribution, which contains only numerically sensitive parameters as well as a completely unsensitive parameter. This indicates that the formulation of free time distribution within the model could be flawed and needs to be reworked. When the model does change behavior, it is only between two distinct behavioral modes – one where the SP crashes as capacity reaches zero, and the other where a balanced position is found that assures longevity, implying no additional outside changes.

For the integration error testing, the model was adjusted to 4^{th} order Runge-Kutta with a DT of 0,25. This assures reasonable computational speed and precision, as lowering the DT or changing the method to Euler did not yield different results.

Finally, the behavioral reproduction test resulted in confirmation from the current president of the SP as feasible, given the input parameters. Precise data points are not taken into great consideration, rather it is the patterns which the behavior shows that closely correlates to what is the expected behavior of the model. Behavior will be discussed in more detail in the following chapters.

ANALYSIS

The baseline run is determined to be the expected behavior if nothing changes from the reference mode. The stocks that will be observed are “Support given to SP” and “Working capacity. In the baseline run, the behavior of these stocks accurately matched those theorized in the reference mode. See the graphs describing the baseline run in figure 3. The loops referenced in the analysis are found in the model structure found in appendix A.

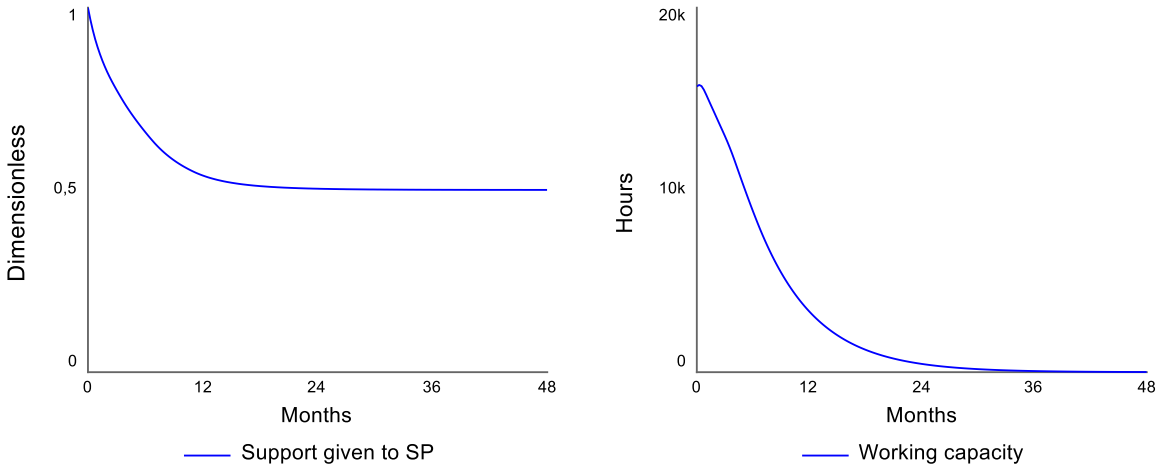


Figure 3 – Baseline behavior graphs for (left to right): Support given to SP and Working capacity.

At the beginning, the working capacity is adjusted through the limit capacity change loop B1 to match the available capacity. With the capacity that the SP has, they work on both academic and social projects. Immediately, there is a difference between the expected and actual academic projects being made, which creates negative impact on affinity – meaning that loop B5 or support checks priorities is at work. As the lowering affinity lowers support from the original value of 1, it decreases social project prioritization, seeing as the SP notices that they are not in the good graces of the administration anymore. Social project prioritization begins to lower, which increases academic projects, closing loop B5. Meanwhile, the SP is working hard creating social projects and attempting to increase their member motivation and support through loops R1 and R3. Total SP activity actually increases, and more students join the SP through the feedback of R1 and more time is also being spent in the SP through loop R3. However, saturation mitigation starts to lower in value, as the new members overcrowd the SP slightly above the optimal student amount. Sadly, the increase in student capacity is overshadowed by the loops that have lowered support, mainly R6 and R4. With the SP not being able to complete expectations and not having enough time to reform its capacity, it approaches a downward trend, organizing less and less projects as there is less support offered, which leads to less students finding interest in the organization, meaning, that the loops that reinforce growth now instead reinforce decline of the organization. Around month 36 or 3 years after initial conditions, the SP is at close to zero capacity, kept so that it does not fall below zero through loop B1. Support falls to its lowest possible value.

For further analysis, another scenario shall be analyzed. Applying changes to certain parameters causes the model to exhibit a completely different behavior – one where SP working capacity finds a stable equilibrium after a period of oscillations. This mode can be achieved in a number of ways that do not vary the patterns seen, but slightly alter the specific resulting numbers. We shall analyze the scenario (called optimal scenario) in which higher education becomes more widespread and a larger number of students join the university, from 10,000 to 11,000. Since all of the new students have the same chance of initially being interested in the SP as normal, the normal fraction of active students in SP remains unchanging. It is important to note that a higher number of

students could and could not demand higher amounts of expected projects, but in this scenario that is not taken into account. The graphs for the stocks observed in the baseline scenario and how they compare to the new values can be seen in figure 4.

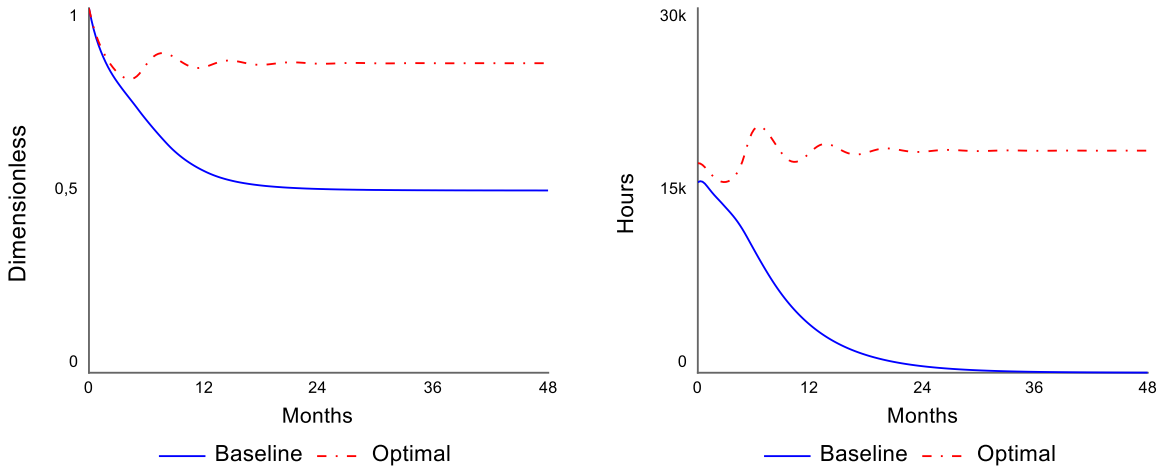


Figure 4 - Baseline behavior graphs compared with optimal behavior graphs for (left to right): Support given to SP and Working capacity.

In the optimal scenario, more students in the university implies a higher number of students as members in the SP. This increases initial working capacity and allows for the creation of more projects than before. As the SP begins creating academic projects, they can create more than before, increasing the relative number of them slightly, which doesn't decrease the support as much as before through loop B5. This balances the social project prioritization less in the favor of the administration than before, allowing for slightly more social projects, which, keep in mind, can also be made with greater quality due to the support granted by loops R4 and R6. Meanwhile, the social projects created at that same time create interest through loops R1 (and R2 through academic projects) as well as R3 in the free time sector. The growing interest in the new members causes initial saturation mitigation to drop with loops B7, B8 and B9, which lowers available capacity, causing the initial dip seen in the graph, but not for very long. As the member count somewhat balances through the saturation loops (B7, B8, B9), the available capacity begins working more efficiently. This causes more academic projects to be made, which now come closer to supporting the expectations of the administration. As affinity increases, support also begins to increase close to what is expected of the SP. This is the first bump noticeable on the graph and represents the work of loops B5, B6 as well as R4. This bump doesn't last for long, and the answer as to why can be found when looking at fraction of free time spent in SP. Initially, fraction of free time spent in SP increased as activity was high due to new arrivals (the work if loop R3), but, since too much time was spent in the SP, grades began falling below what was acceptable for the SP members (the work of loop B6 or grade motivation), so, they required time to return grades up to acceptable standards, causing less time to be spent in the SP. Once the grades were returned to the needed levels, more time could be spent in the SP, leading to an again increased capacity. This is the second peak noticeable in the graphs. The system now continues to work as it did before, and not like in the baseline model, there is not enough of a decrease in the capacity for the SP not to be able to keep up with administration standards. The oscillations caused by the flow between loop B5, which causes the other reinforcing loops in the model to shift to their negative behavior, and these same reinforcing loops (mainly R1, R3 and R6) being set back into positive behavior from the built-up capacity are finding an equilibrium amongst themselves. The same process is happening between loops responsible for distributing free time, with R3 motivating more time spent at the SP and B6 motivating a controlling of grades. As the behavior continues, an equilibrium is reached, where support finds an optimal value at around 0,85 or 85%, meaning that full expectations are never

really reached with regards to academic projects, however, that difference is made up by the total SP activity holding up a steady number of members quite close to the optimum number (678 students at the end). In this scenario, fraction of free time spent in SP balances at around 0,147, which is quite close to its initial value of 0,14. In fact, many of the parameters in this scenario reach slightly above their initial levels at the end of the simulation time, including students in SP, working capacity and support.

It is important to remember that the results above can also be achieved through multiple other pathways. Figure 5 shows the working capacity behaviors of three other options of flipping the behavior from a slow burn to a hopeful stability. These scenarios imply policy options that serve as potential solutions to the problem that the SP is facing. However, it is in the hands of the leader to select which is most feasible for them and the team of members they have at their disposal.

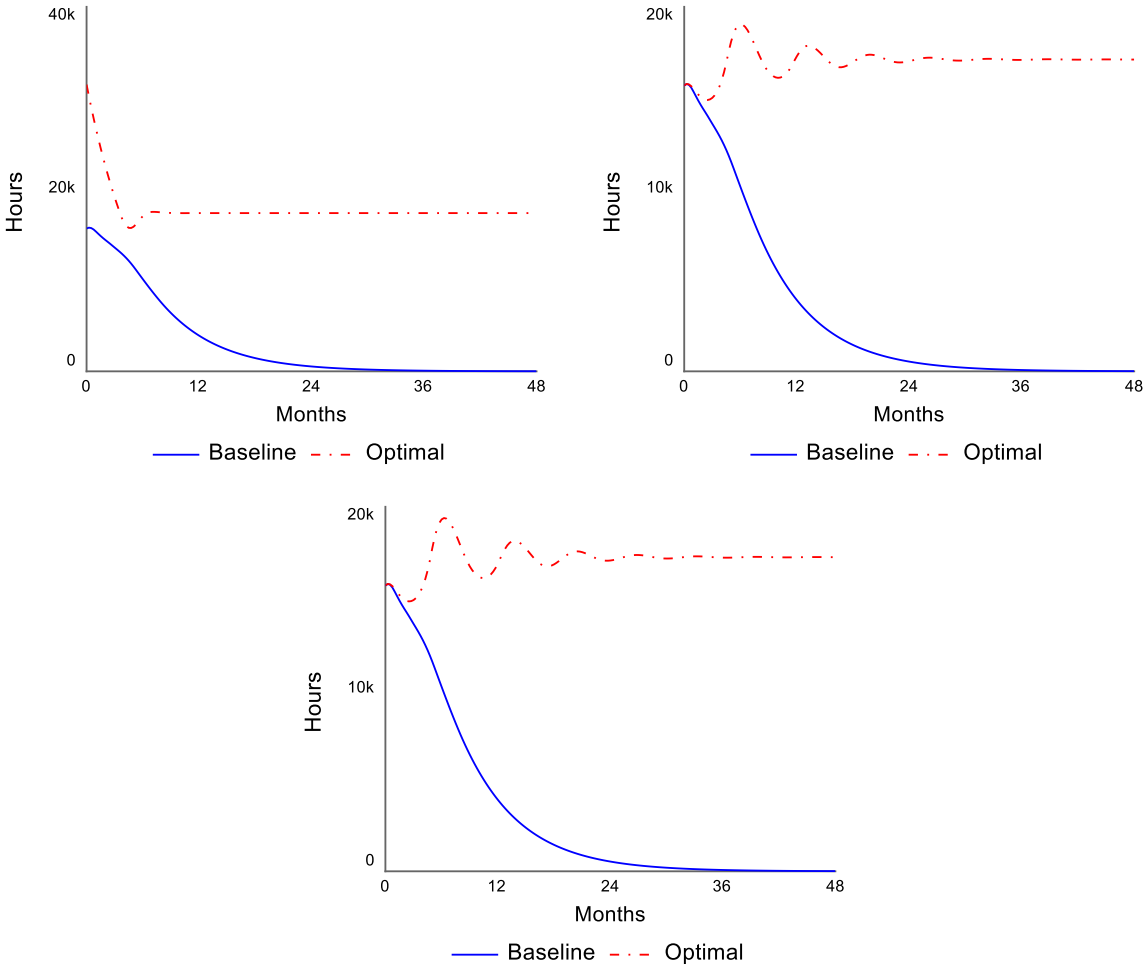


Figure 5 – Baseline behavior graph for working capacity compared with optimal behavior when (from left to right): increasing normal fraction of active students in SP from 0,05 to 0,1, decreasing expected academic projects from 40 to 35 and decreasing normal effort for one academic project from 360 to 320.

DISCUSSION AND CONCLUSIONS

This report and it's supporting model serves an explanatory purpose, not a predictive one. The problem that the SP faces is complex, inferring in itself countless parameters that could be taken into account when determining its parts. Does the weather impact how much students want to see the SP perform? Do the country's recent achievements in science dictate how much is expected from the SP? Is the youth movement phenomena simply coming to a decline [10]? After speaking with the president of the SP, the answer to a lot of these questions is: "Yes.", meaning, that the best we can do is create a model that outlines a very general scenario of the real-life system.

In terms of structure, it is clear that there is a tipping point in this model, where the capacity of the SP cannot keep up with both satisfying demands of the administration and keeping engagement of their members as well as bringing in new students. The closer the organization is to this tipping point; the more volatile changes will be in order to bring it back to standard operation. The many reinforcing feedback loops of the model are both a blessing and a curse – they allow for growth on growth, but also failure on failure, and, at the current situation, it is in the hands of the administration whether or not these loops serve to help or hinder the SP. But blame cannot be put solely on the administration. It is understandable that there is a clear difference in priorities on both sides – the SP and its goal audience – students – care much more for social projects than they do for academic ones. University already burdens students with enough academia as it is, so rare is the student who prefers even more of it. But this, again, is an unpredictable variable.

All in all, my findings closely match the proposed situation from my own experiences and those of the SP president, as well as offers a hopeful future for the SP, given that proper care is taken in its future guidance. This implies many possible plans of action that can be presented to the people in charge. The model, given improvements and expansion of scope, can offer itself as a valuable tool for both new and experienced members of the organization.

Implementing the policies this report implies will be dependent on whoever is in charge of the SP in the future. Since the organization mainly deals with people and their personalities, it is the personalities of the people involved that will determine which policy is feasible or not. In truth, all of them are given the right circumstances. Administration could be persuaded to lower standards for support if the SP representative is persuasive enough, and fraction of students in SP can be increased with a skilled enough marketing campaign.

The model is limited to working within very strict and firm boundaries. There is little room for random chance, even if the SP is an organization which is fundamentally dependent on outside variables and randomness. A single bright individual among students can be what leads it on the path of continued success, just as easy as an equally bad-tempered individual can sour relations with administration to a nigh unfixable degree. However, it doesn't mean that the model cannot be referred to at all. If expanded to include processes such as the competence of members, which grows over time, then interesting insights may be gotten about how "passing the torch" is handled in a decreasingly supported organization, as well as possible impacts of the SP outside of the university area could be taken into consideration, such as what impact it may have on youth yet to choose a higher education path or how home lives of members tend to improve, leading to higher devotion to the organization and less of a chance of them leaving it. A better understanding of the administration's thought process and operations could lead to a more robust interpretation on their side of the problem. How much do the other departments receive? How are they performing compared to the SP? Does the performance of the SP impact other university departments? And how does the administration react to all that? These are all valid questions that, if answered, could drastically change the model structure, and affect the scope of its utility as a predictive tool.

REFERENCES

[1] Griebler, Ursula & Nowak, Peter. (2012). Student councils: A tool for health promoting schools? Characteristics and effects. Health Education. 112. 105-132. 10.1108/09654281211203402.

[2] Aymoldanovna, A.A., Zhetpisbaeva, B.A., Kozybaevna, K.U., Kadirovna, S.M. (2015) Leadership Development University Students in the Activities of Student Government. Procedia - Social and Behavioral Sciences, Vol. 197, 2131-2136, https://doi.org/10.1016/j.sbspro.2015.07.336

[3] Miller, K.D., Schleien, S.J., Rider, C., Roche, M. Worsley, J. (2002) Inclusive Volunteering: Benefits to Participants and Community. Therapeutic Recreation Journal. Vol. 35, No. 3, 247-259.

[4] Yuksel, S. and Karadağ, E. (2010) Views of School Managers and Teachers Regarding the School Councils Project. Current Issues in Education, 13(4). Retrieved from http://cie.asu.edu/

[5] Moles, O.C. (1989) Strategies to Reduce Student Misbehavior. Office of Research, Office of Educational Research and Improvement, U.S. Department of Education.

[6] Riga Technical university (2022) RTU 2022. Gada pārskats [Online]. Available at: https://www.rtu.lv/lv/universitate/skaitli-un-fakti/rtu-2022-gada-parskats (Accessed: 21 December 2023)

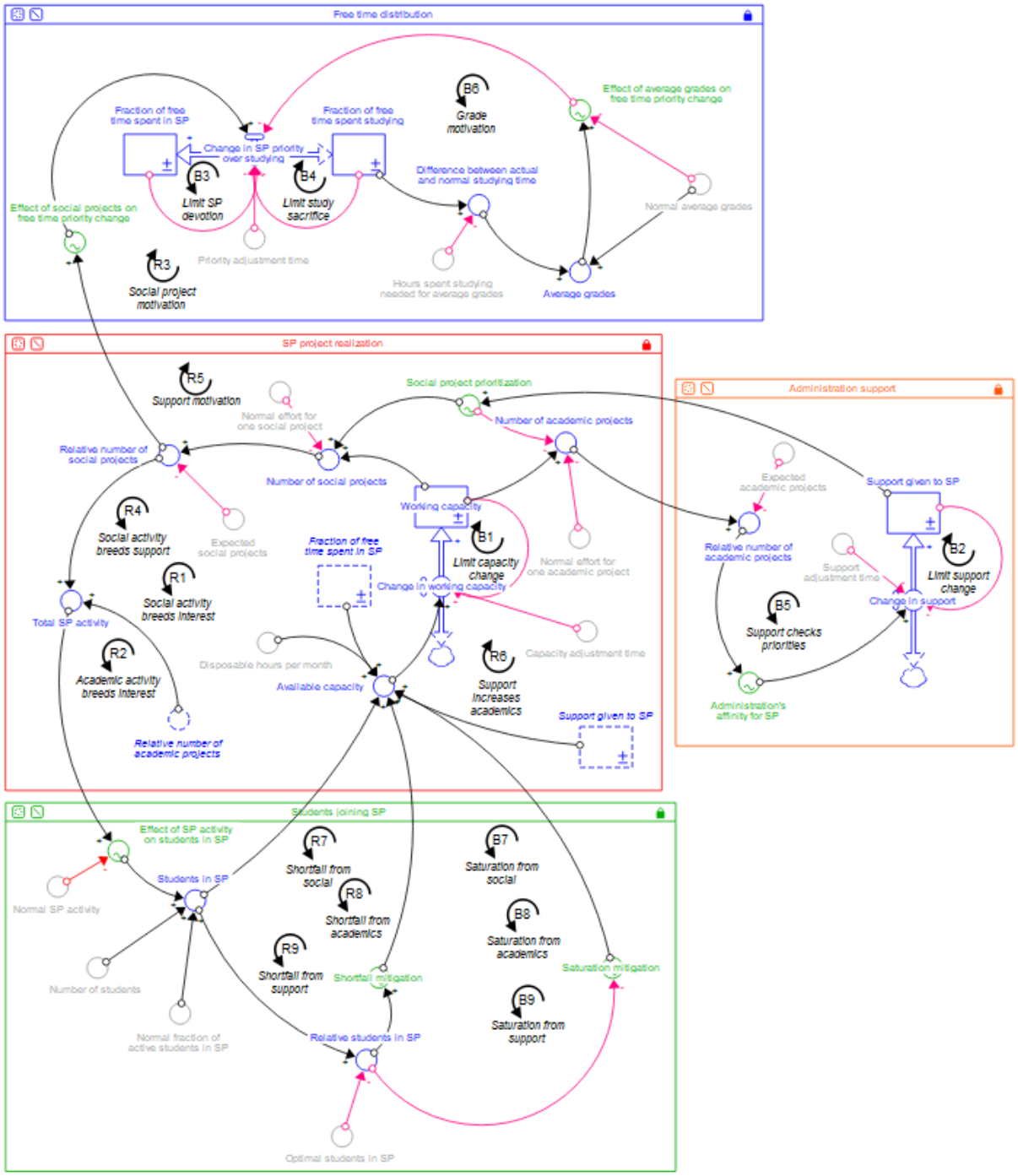
[7] Dunham, S., Cox, W.C., Wingo, B.L., Zeeman, J.M. (2020) Evaluation of a Council Structure and Meeting Format for Pharmacy Student Government in the Co-Curriculum. Am J Pharm Educ. 84(10) doi: 10.5688/ajpe7755.

[8] Barlas, Y. (1996) Formal aspects of model validity and validation in system dynamics. System Dynamics Review, 12, 183-210.

[9] Rahmandad, H., and Sterman, J. D. (2012). Reporting guidelines for simulation-based research in social sciences. *System Dynamics Review*, 28(4), 396-411. doi: 10.1002/sdr.1481

[10] Kahane, R. and Rapoport, T. (1997) The Origins of Postmodern Youth: Informal Youth Movements in a Comparative Perspective. Walter de Gruyter.

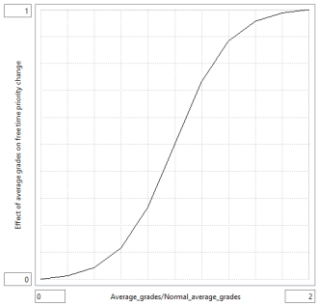
APPENDIX A: MODEL STRUCTURE

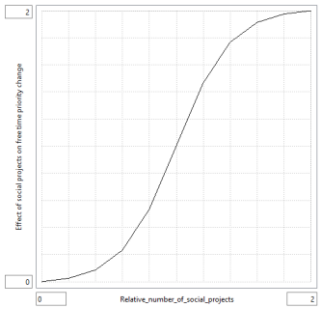


APPENDIX B: MODEL DOCUMENTATION

Variable	Equation	Units	Documentation
Free time distribution			
Fraction_of_free_time_spent_in_SP(t)	Fraction_of_free_time_spent_in_SP(t - dt) + (Change_in_SP_priority_over_studying) * dt INIT = 0,14	Dimensionless	Fraction of free time spent in SP represents the amount of free time focused on working in the SP. This includes day to day work in the SP, including working on different projects, contacting sponsors for SP events and speaking with administration about how the SP is functioning and getting insights into their support of the SP. The stock can only change through the bi-flow "Change in SP priority over studying". This formulation means that the free time considered here must be used for one or the other, no matter the proportions. It decreases when priorities shift to studying and vice versa. The stock begins at 0,14. This implies that 14% of the free time one has outside of life necessities is spent working for the SP, while the remaining percent is spent studying. This value cannot increase beyond 1 or fall below 0.
Fraction_of_free_time_spent_studying(t)	Fraction_of_free_time_spent_studying(t - dt) + (- Change_in_SP_priority_over_studying) * dt INIT = 1-Fraction_of_free_time_spent_in_SP	Dimensionless	Fraction of free time studying represents the amount of free time devoted to improving one's grades in university. This does not count as time spent in lectures, but free leisure time devoted to studying, going over notes and putting in extra effort in assignments. The stock can only change through the bi-flow "Change in SP priority over studying". This formulation means that the free time considered here must be used for one or the other, no matter the proportions. It decreases when priorities shift to the SP and vice versa. The stock begins at a value that is 1-Fraction of free time spent in SP. This implies that 1 (or 100%) is the total amount of free time fraction available, and that the time spent studying is whatever time is not spent in the SP.
Change_in_SP_priority_	((Fraction_of_free_time_spent_studying-Effect_of_social_projects_	Per Month	Change in SP priority over studying is a bi-flow that represents how members of the SP allocate their free time, more specifically, how

over_studying	on_free_time_priority_change)-(Fraction_of_free_time_spent_in_SP-Effect_of_average_grades_on_free_time_priority_change))/Priority_adjustment_time		much they prioritize working for the SP versus studying. The flow serves to move a fraction from one stock to the other depending on how much the students wish to spend their free time. The equation works as such: both time spent in SP and time spent studying are compared to effects that determine whether or not it is tempting to continue the current allocation of time. First, fraction of free time spent studying is reduced by the effect of social projects on free time priority change - this determines whether or not work in the SP is more exciting than studying. If the effect is larger than the time spent studying, then the first part of the equation is lower. Second, the fraction of free time spent in SP is reduced by the effect of average grades on free time priority change - this determines whether or not average grades are low enough to merit stress from the student about under-performing in university due to lack of studying. If the effect is larger than the time spent in SP, the second part of the equation is lower. Finally, the first part of the equation is decreased by the second part of the equation, determining if working in the SP is more attractive than studying is at that point or vice versa. The flow is positive if the first part of the equation is larger than the second part (SP is more interesting than keeping up grades) and it is negative if the second part of the equation is larger (the average grades fall to such levels, where SP attractiveness no longer outweighs the stress of under-performing). This resulting number is divided by the priority adjustment time, as a streak in bad grades or the appeal of the SP only is noticed and acted upon after a certain delay in perception.
Average_grades	Normal_average_grades*Difference_between_actual_and_normal_studying_time	Grade	This endogenous variable represents the average grades across all university subjects that the members of the SP attain during their studies. The equation takes the normal average grades and multiplies them by the difference between actual and normal studying time. This means that, if there is no difference between time needed to get average grades and time actually studied - the students will receive their normal grades. If the difference is

			increased beyond 1, the normal grades are multiplied by the value, which increases the average grades, as more time spent studying increases the performance of the students. If the difference falls below 1, the normal grades are multiplied with it and turn lower. The average grades are used to determine the effect of average grades on the free time priority change.
Difference_between_actual_and_normal_studying_time	Fraction_of_free_time_spent_studying/Hours_spent_studying_needed_for_average_grades	Dimensionless	This endogenous variable represents the gap of how much time students spend studying and how much they need to study to get average grades. The equation divides the fraction of free time spent studying with the hours spent studying needed for average grades, which returns a fraction. If the value is at 1, this means that the students are studying exactly how much they need to maintain normal average grades. If the fraction of free time spent studying increases, the fraction also increases, which increases the grades they receive, and the same for the reverse. This difference is used to actually calculate the average grades.
Effect_of_average_grades_on_free_time_priority_change	GRAPH(Average_grades/Normal_average_grades) Points(11):  	Dimensionless	This graphical function represents how a student's average grades compared to their normal ones affect their free time priority change. The shape of the function is an s-shaped growth, with the comparative grades at a value of 1 set to return a value of 0,5, indicating a regular amount of time spent studying for normal grades. As the comparative grades increase above 1, the effect increases decreasingly to a maximum of 1 if the comparative grades reach 2 or twice as high when compared to average. This serves to increase the time spent in SP over studying. However, if average grades compared to normal grades begin to fall below 1, the effect decreases decreasingly until reaching 0. This effectively makes it so that the lower a student's grades are compared to their normal, the less time they spend in the SP and the more time they spend studying. The maximum and minimal points are determined by the formulation of the change in SP priority over time, meaning, that in the context of the

			formula presented there, a minimum amount lower than 0 would result in time being moved into studying from where there is none, and the same for the maximum value of 1.
Effect_of_social_projects_on_free_time_priority_change	GRAPH(Relative_number_of_social_projects) Points(11):  	Dimensionless	The graphical function represents how a change in social projects with respect to the expected amount changes the free time priorities of the SP members. The shape is an s-shaped increase, where the normalized 1/1 point is at the center. This implies that if the relative projects are at expected values (1 or 100%), then the effect of them is 1. The value changes with a changing relative number of social projects. If it increases above normal levels, the effect increases decreasingly to a maximum of 2. This represents how social projects work as motivation tools for the members of the SP, who choose to spend more time in the SP with them increasing. However, they can only increase the priority change to a value of 2 due to social projects only having a limited effect on free time priority change. If the relative amount of projects decrease, there is less motivation to spend time in the SP, so it decreases decreasingly until eventually reaching 0 only if no social projects are created. This represents how the members of the SP still hold on to some level of commitment to the organization even if it doesn't perform as well as usual. These values were assumed from personal experience in the SP, as there is a maximum limit to how much members want to devote themselves to the organization and a slowing of devoted time decrease if it under-performs.
Hours_spent_studying_needed_for_average_grades	0,5	Dimensionless	This is a parameter which represents the required fraction of free time spent studying needed to maintain average grades. This parameter being unchanging means, that all students in the SP have the same aptitude for performing in exams and assignments. Obviously, the hours needed to maintain average grades would differ from person to person, but the parameter is selected as a rough average, indicating that half of the available free time any student has must be spent studying to maintain average grades. This

			number is an observation from my personal experience studying at Riga Technical university.
Normal_average_grades	5	Grade	This is a parameter that represents the average grades that are considered acceptable by the students working in the SP. Realistically, this value would be different for each individual student, as what is deemed "normal" would depend on the person's academic ambitions. It could even change over time as a student gets accustomed to a certain level of average grade that becomes the new normal. For simpicity, the normal has been chosen as slightly above minimal requirements, judging by the grading system used in the Riga Technical university (ten-point grading system), where 10 is the maximum and 4 is the pass mark.
Priority_adjustment_time	3	Months	This is a parameter that represents the time needed for members of the SP to adjust their free time prioritization from studying to spending more time in the SP and vice versa. The time exists because decisions are not taken instantly, there is consideration that must happen before devoting your time to one side or the other. The value is chosen from personal experience as a student in Riga Technical university.
SP project realization			
Working_capacity(t)	Working_capacity(t - dt) + (Change_in_working_capacity) * dt INIT = Number_of_students*Normal_fraction_of_active_students_in_SP*INIT(Fraction_of_free_time_spent_in_SP)*Disposable_hours_per_month	Hours	Working capacity represents the total amount of functional man-hours that the SP has at its disposal at any given time. This is the capacity used to create different projects within the SP. It represents the work put in by all of the members and the support granted to the SP by the administration that alleviates some of the working hours needed to get by otherwise. The stock increases and decreases by adjusting itself to the available capacity with the capacity adjustment time, representing how all assets that the SP has cannot be immediately used to their full potential. New members must be trained, funds must be processed, and other kinds of support also take their time to be

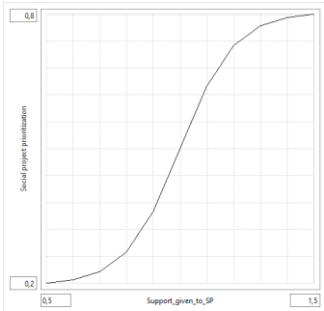
			usable after being granted. The initial working capacity is calculated at the start of the simulation by taking the normal fraction of active students in SP and multiplying it by the number of students. To represent the man-hours this labor force puts in, the amount is multiplied further by the initial fraction of free time spent in SP, as well as the disposable hours per month.
Change_in_working_capacity	(Available_capacity-Working_capacity)/Capacity_adjustment_time	Hours/ Months	Change in working capacity is a bi-flow that represents the rate at which working capacity adjusts every time step. The larger the difference between the working capacity of the SP and the available capacity, the higher the flow rate. The change in working capacity is a process that entails different parts that make up the available capacity being processed before being usable as actual working capacity that creates projects. This is represented in the equation, showing that the flow rate equals the available capacity of the SP minus the working capacity, meaning that the working capacity adjusts to whatever the available capacity is. However, some time needs to pass before all capacity assets can be fully utilized, as new members need to be trained, funds and resources processed, etc., so the difference is divided by the capacity adjustment time, leading to a gradual adjustment of working capacity to available capacity over time. The rate increases positively when available capacity increases over working capacity, and goes negative if the opposite happens.
Available_capacity	Students_in_SP*Disposable_hours_per_month*Fraction_of_free_time_spent_in_SP*Support_given_to_SP*Shortfall_mitigation*Saturation_mitigation	Hours	This is an endogenous variable that represents the available working capacity that the SP has. The capacity is measured in hours or man-hours and takes into account all of the members, the amount of time they put in the SP and how much support is granted to the SP from the administration. The capacity is also effected by the saturation and shortfall mitigation that happens in the SP depending on how many members it has. If it has too many, saturation becomes an issue, and the same with shortfall it it doesn't have enough. The equation is a simple multiplication of all of the variables

			included. Plain man-hours are calculated by members multiplied with the fraction of time they spend in the SP and the number of disposable hours they have per month. The plain man-hours are either increased or decreased by the amount of support given. Since support is given as a fraction, a standard amount of support results in no increase or decrease to the hours. If support is higher than usual (over 1), then the man-hours are effectively increased, as some of the administration may help to organize events, provide funds to lessen the required work needed to be done if the SP had none and allowing processes that take more time usually to go smoother. If there is less support, the opposite happens and effective hours are reduced. Apart from support, the plain man-hours can be effectively decreased with a decrease in shortfall or saturation mitigation. If the member count is optimal or close to it, little to no change is brought on by these effects, however, if there is a noticeable difference in either direction, the effects can lower effective man-hours by providing hurdles to be overcome that come with a too low or too high member count.
Capacity_adjustment_time	6	Month	This is a parameter that indicates how much time is required to adjust available capacity of the SP to the working capacity. The time represents that available capacity in the form of members, time and support from the administration cannot be utilized for project organization instantly but requires being processed beforehand. This occurs in life through new members requiring training, their time spent in the SP being devoted to project organization and the resources granted by administration needing to be processed through financial staff, contacts needing time to be formed by administration and parties that they can contact, etc. The adjustment time is set at half a year due to that being the approximate time where new members gain the full capabilities of experienced members through training and seminars and can fully contribute to project organization.

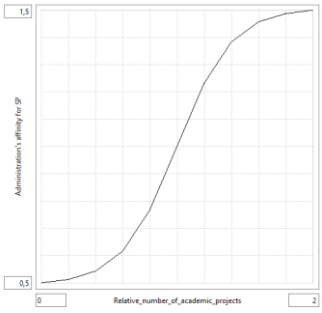
Disposable_hours_per_month	8*28	Hours/ Student	This is a parameter that represents how many hours per month does every member of the SP have to spend either studying or working in the SP. Realistically, this value would be different for each individual student, as some have more time free and some would have less depending on their lifestyle, life situations and other restraints, such as work, study progeram, etc. The average is taken judging from personal experience when working in the university. The parameter is calculated by taking average free time available for a day (taking the 24 hours in a day, removing 8 for sleep and 8 for university, commute and eating) and multiplying it by the average amount of weeks per month (4 weeks = 28 days).
Expected_social_projects	24	Project	This is a parameter, which represents the standard number of social projects organized and expected from the SP under normal working conditions (BAU). The term "projects" is arbitrary and can represent a lot of different fields of work that the SP conducts, such as team-building activities, cultural events, sporting events, leadership seminars as well as more simple day to day conflict resolution, marketing, and other quality of life supporting projects that improve the life of those at the SP. The expected amount of these projects is roughly chosen, given the knowledge from the interview conducted with the president of the SP, who explains a roughly 60/40 split in social versus academic projects, and also taking into account a quicker realization time for social projects due to decreased effort. The number would also be subject to change depending on the wishes of the current student body in any given year, that might be different based on generational preferences. The current value is selected as an estimation.
Normal_effort_for_one_academic_project	360	Hours/ Project	This is a parameter that represents how many man-hours of working capacity are needed to produce one academic project. This time represents time and resources put into the planning, organization and execution of these projects, which includes everything from researching necessary information for the

			project to contacting administration, gathering for meetings, consulting students, etc. Academic projects require more effort to organize, since they often demand a certain level of quality and exactness to be up to standards, since they are The value of necessary hours per project is derived from an interview with the SP president, who has had experience in organizing events. They indicated that an average academic project would take at least twice as much effort as a standard social project of the same magnitude, given the extra precautions necessary to complete it and the overall increased difficulty of them.
Normal_effort_for_one_social_project	180	Hours/ Project	This is a parameter that indicates how many man-hours of working capacity are needed to produce one social project. This time represents time and resources put into the planning, organization and execution of these projects, which includes everything from meetings, creating audio visual materials, contacting sponsors, marketing, distributing funds and ordering materials, speaking to students and administration, etc. Social projects also generally offer far more creative expression, which lowers the bar of entry for members and reduces difficulty of these types of projects. The value of necessary hours per project is derived from an interview with the SP president, who has had experience in organizing events. They indicated that an average social project requires roughly a team of 10 members meeting weekly for 3 months (12 meetings), spending 1,5 hours per meeting. These numbers are multiplied to arrive at the value given.
Number_of_academic_projects	Working_capacity*(1-Social_project_prioritization)/Normal_effort_for_one_academic_project	Project	This is an endogenous variable that represents the number of academic projects that can be executed by the SP with the working capacity. It changes by changes in the working capacity and with changes in the social project prioritization, as the normal effort for one academic project remains unchanging. The equation explains that the total working capacity of the SP is used to create as many

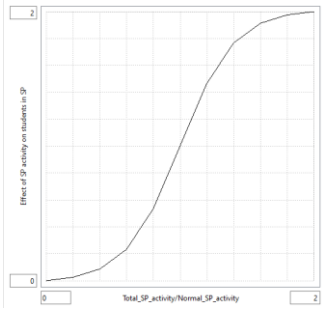
			academic projects as it can, taking into account the normal effort it takes to create a single academic project and how much social projects are prioritized over academic projects. If the prioritization value increases, more of the working capacity is set aside for social projects, decreasing academic projects. If the value decreases, more academic projects are created.
Number_of_social_projects	Working_capacity*Social_project_prioritization/Normal_effort_for_one_social_project	Project	This is an endogenous variable that represents the number of social projects that can be executed by the SP with the working capacity. It changes by changes in the working capacity and with changes in the social project prioritization, as the normal effort for one social project remains unchanging. The equation explains that the total working capacity of the SP is used to create as many social projects as it can, taking into account the normal effort it takes to create a single social project and how much social projects are prioritized over academic projects. If the prioritization value increases, more of the working capacity is set aside for social projects.
Relative_number_of_social_projects	Number_of_social_projects/Expected_social_projects	Dimensionless	This endogenous variable compares the number of created social projects with the number of projects expected by the students of the university. The equation returns a dimensionless fraction, as number of social projects is divided with the expected amount. If this fraction returns 1, that means that there are as many projects organized as expected, a higher number means that there are more projects than expected and vice versa. This value is used to calculate total SP activity an also determines the effect of social projects on free time priority change.

Social_project_prioritization	GRAPH(Support_given_to_SP) Points(11): 	Dimensionless	This graphical function represents how the working capacity of the SP is divided between organizing social and academic projects. It is shaped like an s-shaped growth with it being normalized when support given to the SP is 1 and social project prioritization is at 0,5. This implies that with a regular amount of support from the administration, the SP splits its capacity halfway between social and academic projects. As support given to SP changes, the SP notices and adjusts accordingly - more support leads to less stress from falling support and an increase in social projects (causing the social project prioritization to increase), while less support leads to more academic projects, as members of the SP notice they should be working in the favored branch of the administration (causing social project organization to decrease). The increases and decreases are decreasing from the middle point, forming the s-shape, because approaching the maximum and minimum values of social project prioritization leads to less confident decisions of priority switching, as moving too much into one sector would mean ignoring the students that appreciate one side over the other, causing more problems and complaints about the SP only organizing one kind of project. The maximum prioritization cannot reach over 0,8 or 80% of working capacity and the value cannot fall below 0,2. These values are estimated from my personal experience working in the SP and are based in the reasoning mentioned above.
Total_SP_activity	Relative_number_of_academic_projects+Relative_number_of_social_projects	Dimensionless	This endogenous variable determines how active the SP is with respect to normal conditions. The equation is a simple addition of the relative number of social and academic projects, which themselves compare how proportionally active the organization is compared to business as usual. The total activity changes as soon as either expected social or academic projects increase or decrease. The total activity is used to calculate the effect of the activity on students, as, judging from the answers of the interview with the SP president, there is not a large difference in what kind of projects are

			organized - they all increase exposure, which draws students to it.
Administration support			
Change_in_support	(Administration's_affinity_for_SP-Support_given_to_SP)/Support_adjustment_time	Per Month	Change in support is a bi-flow that represents how the support that the administration grants to the SP is directly related to what the administration's affinity for the SP is. It shows that affinity turns to support over time, as the administration takes time to evaluate performance of the SP and gives it a chance to recuperate after a few bad weeks before making a decision on how much support they will grant. The equation for the change in support equals administration's affinity for SP less support given for SP, indicating that the support always adjusts to what the affinity is. To take into account the time needed to adjust this support, the difference is divided by the support adjustment time. The flow rate ends up being positive or negative depending on how much active support differs from the current affinity. As affinity decreases, the flow becomes negative as support falls along with the affinity. If affinity increases above current suport, the flow turns positive to adjust the support to match the affinity.
Support_given_to_SP(t)	Support_given_to_SP(t - dt) + (Change_in_support) * dt INIT = 1	Dimensionless	Support represents the assistance to general operation that the administration of the university grants to the SP. Support can come in the form of assistance with finding contacts outside of the SP's reach, increasing funding and allowing certain processes to flow smoother without the need for time-consuming bureaucracy to help bring projects to realization faster and to a higher standard. The stock changes with the bi-flow named "Change in support". It adjusts to the administration's affinity for SP after a support adjustment time. This represents how the administration's outlook on the SP can change rapidly, but they will usually think for a while before actually letting that affect their support for the organization to not seem like they are

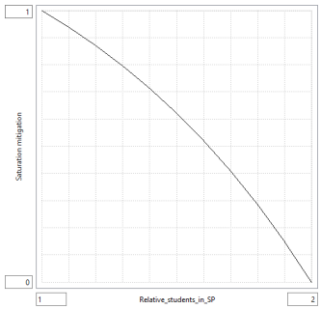
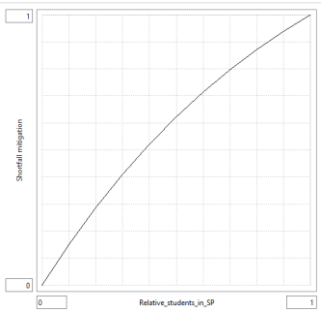
			over reacting and to judge if their loss in affinity is not simply due to some outside factors that the SP had to face for a short while. When at a value of 1 (or 100%), it represents the normal amount of support given by the administration, which is also the initial value. An increase in the value means that support is being offered to the SP which is greater than normal, and a value below 1 represents the opposite.
Administration's_affinity_for_SP	GRAPH(Relative_number_of_academic_projects) Points(11):  	Dimensionless	This graphical function represents how increasing academic projects that the SP creates increases the affinity for the SP that the administration holds. It is shaped as an s-shaped growth and contains a normalized 1/1 point at the center. This indicates that at an expected number of academic projects, the administration's affinity is at expected levels, as in, the SP is left to work without any administration interference. If the relative number of academic projects increases, so does the administration's affinity for the SP, as they over-perform more than they expected. This causes them to appreciate the work they do and offer support in return. However, the support increases decreasingly until it reaches the maximum level of 1,5. If the SP continues to over-perform after that point, the affinity can no longer increase, as the administration can only spare enough resources up to a certain point before they need to stop, less they start neglecting other sectors of the university. If the SP under-performs in the academic block, lowering the relative number of academic projects below 1, the affinity begins to decrease decreasingly as the administration becomes disappointed with the activity of the SP in the academic sector. However, support can only be lowered until a value of 0,5. This represents the fact that the university requires the SP to stay in existence and operate even if it does not meet their expectations. The value of the maximum and minimum affinity is only an estimation, as precise values cannot realistically be measured, but can be inferred by the limits in which the administration can work. The SP president interview also supports this formulation, as they have a better contact

			with the administration than any other student in the university.
Expected_academic_projects	40	Project	This is a parameter indicating what is the standard expected number of academic projects that the SP would create in normal working conditions. The term "project" here is used abstractly and can indicate both large scale events dedicated to certain science topics, active work with the teaching staff to increase quality of education, working with smaller issues from individual students as well as generally working towards a more student-friendly environment in the university in the academic field. The expected number is observed both by the administration, which care more for the projects that bring the university closer to the world-wide top 500, and by students who appreciate their issues being addressed. The value set is a rough estimation. From the interview with the SP president, business as usual conditions expect a roughly 60/40 split between social and academic projects, with academics being in the lower side. As it usually takes more time to complete academic projects than social ones, the expected number is set slightly higher than the expected number of social projects, as the administration has become more determined to reach the university top 500, and therefor expects more from the SP.
Relative_number_of_academic_projects	Number_of_academic_projects/Expected_academic_projects	Dimensionless	This endogenous variable compares the number of created academic projects with the number of projects expected by the students and administration of the university. The equation returns a dimensionless fraction, as number of academic projects is divided with the expected amount. If this fraction returns 1, that means that there are as many projects organized as expected, a higher number means that there are more projects than expected and vice versa. This value is used to calculate the administration's affinity for SP.

Support_adjustment_time	3	Months	Support adjustment time is a parameter that represents the time in months needed for the administration's affinity for the SP to reflect on their support of the SP. The faculty support the SP in many ways, by they judge the amount of support or amount of obstacles they will lay in front of the SP depending on how much they like what the SP is doing. As they see their support being used to create different projects, they adjust how much they are willing to continue supporting. This change happens over time. The value of this adjustment time is estimated at the current value based on the perceived situation of myself when working in the SP. This indicates a quarterly recap of the SP's productivity with regard to the administration's standards. A higher number would be unreasonable, as the administration are aware that the people in charge of the SP change on a yearly basis, but a lower number would indicate a level of pragmatism from the administration, which it tends to avoid, rather contemplating more before deciding to increase or decrease support in case the SP is just going through a rough few weeks.
Students joining SP			
Effect_of_SP_activity_on_students_in_SP	GRAPH(Total_SP_activity/Normal_SP_activity) Points(11): 	Dimensionless	This is a graphical function that represents how the total activity of the SP affects how many students join or leave the SP as members with respect to the normal SP activity. It changes whenever the total SP activity changes, which changes the relative SP activity, formulated as total divided by normal activity. This fraction determines the effect of activity. The graphical function is shaped like an s-shaped growth, with a lower relative affinity than the normal value of 1 leading to a decreasingly decreasing slope (due to an initial decrease in activity leading to a larger amount of students being disinterested by what the SP has to offer, but the decrease slows down as an even lower activity compared to regular levels only leaves the most dedicated members to the SP). With a higher relative activity, the slope increases decreasingly (due to an initial interest spike as

			activity increases, but slows down as there are only so many students that an afford to spend time in the SP). The value can only increase up to a value of 2, meaning, that twice as many students than usual join the SP, which is realistic, as membership is only possible for students who have the time for the SP, as mentioned in the interview with the SP president. The value can reach 0 only if total activity is 0, as any activity would bring some students to the organization, but, if there is really no activity from the organization, it would effectively be invisible to the student body. It cannot go below 0, as that would imply that a negative amount of students join the SP, which would imply an active resistance against the organization that would work to bring the capacity of it down, which is unrealistic.
Normal_fraction_of_active_students_in_SP	0,05	Dimensionless	This is a parameter indicating the fraction of students in the university that are counted as members of the SP under normal operating conditions. It represents what percentage of the total student body is actively working in the SP to create projects. The value was selected by taking the total amount of students in the university that the SP applies to and dividing it with the actual member count of the SP from current data of the RTU.
Normal_SP_activity	2	Dimensionless	This is a parameter that represents the standard activity of the SP, specifically, how active the SP is when putting in normal effort in creating academic and social projects. The value shows, that at normal capacity, the SP is expected to produce as much academic projects as they normally do (the relative number of academic projects = 1) and as many social projects as they normally do (the relative number of social projects = 1), coming to a total value of 2. With normal activity, the regular amount of students currently a part of the SP will remain.
Number_of_students	10000	Student	This is a parameter that represents total amount of students in a university who qualify for potential SP members. Since the model is based off of the operation of Riga Technical

			university, the student number is a rounded up value taken from the 2022 RTU yearly report of active students, not including college, master or doctorate level studies, as these groups participate in the SP only on a few specific occasions.
Optimal_students_in_SP	600	Student	This is a parameter that represents the number of students that, if working at the SP, could work without any hindrance brought on by a shortfall in labor or saturation of people. Anything above, and there would be too many people to keep track of, some members would not find any jobs to do, others would get demotivated that there are other students doing what they're doing in the SP and so on. Anything below this number and students begin struggling to meet deadlines of projects and more time needs to be invested in managing the structure of the SP rather than working on projects. This can come in the form of there not being enough people to handle communication with administration, cleaning the SP offices, recruiting new members, etc. The value of this was set referencing an interview with the president of the SP, who has had 5 years of experience working in the organization, and therefor, is qualified to set a rough estimate of the team size they need to have a fully functioning organization without any setbacks from shortfall or saturation.
Relative_students_in_SP	Students_in_SP/Optimal_students_in_SP	Dimensionless	This endogenous variable represents how many students there are in the SP respective to the optimal amount of students in the SP, given as a fraction. Since the optimal amount of students is an unchanging parameter, the relative amount of students can only change when the students in SP change. The students in SP are divided with the optimal students to return a fraction with 1 representing students being in optimal amounts for the SP to work with full productivity. Anything above and the SP has too many members, anything below and a members shortfall occurs. This value is needed to calculate the effects of shortfall and saturation.

Saturation_mitigation	GRAPH(Relative_students_in_SP) Points(11): 	Dimensionless	The graphical function represents how an overabundance of members causes internal issues that kill productivity after a certain point. The relative number of students in SP is what drives change in this variable. The functions shows a logarithmic decay or collapse, normalized to start at the 1/1 point at its maximum value and fall increasingly as the number of relative students increases. If the value of relative students is 1 or below, then there are no issues specifically from saturation, leaving the effect at 1. However, if the number of students in the SP increases above the optimal amount, the effects of saturation begin to show. More students means that work needs to be found for all of them. There is a lot of work to be done in the SP, but with an increasing amount of members working, even more work needs to be done to track who is doing who. This is not very noticeable at lower levels, but as the relative students increase, more problems arise which spiral into a decreased available capacity. With close to double the amount of optimal students in the SP, multiple people are assigned to do the same tasks, which leads to some of the work being doubled with no gain from it and the current working structure of the SP cannot support that amount of people. At exactly double the amount of relative students above normal conditions, the SP can no longer function as the saturation mitigation reaches zero. This causes all available capacity to become useless, as too much confusion builds. This shape and explanation was supported by the SP president during their interview.
Shortfall_mitigation	GRAPH(Relative_students_in_SP) Points(11): 	Dimensionless	This graphical function represents how the decrease of students in SP under the optimal number affects available capacity of the SP. It is shaped as logarithmic growth or goal seeking increase, normalized to a value of 1 to 1 at the maximum. Since the effects of shortfall only begin to be felt once relative number of students in SP drops below 1, there is no option for the value to increase. If the value of relative students stands at 1, there is no shortfall problems and all duties can be completed with no member feeling as if they

			have to pull the slack of any uncompleted tasks. As the relative students drop below 1, the effects on the available capacity are not as severe at the start, but the effects of shortfall begin showing as the relative student number continues to decrease. With a larger decrease, there is less shortfall mitigation as the necessary work that the SP does cannot be complete with the amount of people, leaving the organization short-staffed, causing a decrease in the available capacity. The less students there are, the increasingly less work can actually be done, because the remaining ones are forced to complete obligatory tasks rather than focus on marketing or creative projects. This also kills morale, as the students who remain at the SP have to work overtime and get frustrated at the reality of that. Eventually, if there are no students in the SP, leaving relative students at 0, shortfall mitigation also falls to 0. The shape of this graph was agreed upon with the president of the SP, who corroborated the story outlined above.
Students_in_SP	Number_of_students*Normal_fraction_of_active_students_in_SP*Effect_of_SP_activity_on_students_in_SP	Student	This is an endogenous variable that represents how many students are members of the SP in the university. The equation this variable has determines that it can only change through the effect of SP activity on students in SP, as the other two parameters included in the equation are static and represent normal conditions. This means that when the activity of the SP is as expected, the normal fraction of active students participate in the SP as members. When the effect increases, the fraction of students active in the SP is lowered, which gives the number of students after multiplying the fraction with the total number of students.

Run Specs	
Start Time	0

Stop Time	48
DT	1/4
Fractional DT	True
Save Interval	0,25
Sim Duration	1,5
Time Units	Months
Pause Interval	0
Integration Method	RK4
Track flow quantities	True
Keep all variable results	True
Run By	Run
Calculate loop dominance information	True
Exhaustive Search Threshold	1000

Feedback loops	
R1 (Social activity breeds interest)	When the SP creates academic projects, the total SP activity increases, this leads to the SP being noticed more in the student ranks and increases the effect of activity on students. This causes students in SP to increase, which increases the available capacity. This increases the working capacity after an adjustment time, which then further increases the number of academic projects created. The opposite can happen if the number of academic projects decrease. As that happens, the relative number of projects decrease below what is expected of SP, which decrease its total activity. This causes a decrease in the effect of activity on students in SP, lowering member count, which lowers the available capacity,

	lowering working capacity after an adjustment time. This leads to less academic projects being created.
R2 (Academic activity breeds interest)	When the SP creates academic projects, the total SP activity increases, this leads to the SP being noticed more in the student ranks and increases the effect of activity on students. This causes students in SP to increase, which increases the available capacity. This increases the working capacity after an adjustment time, which then further increases the number of academic projects created. The opposite can happen if the number of academic projects decrease. As that happens, the relative number of projects decrease below what is expected of SP, which decrease its total activity. This causes a decrease in the effect of activity on students in SP, lowering member count, which lowers the available capacity, lowering working capacity after an adjustment time. This leads to less academic projects being created.
R3 (Social project motivation)	An increase in SP organized social projects leads to a higher relative number of social projects with respect to how many are regularly expected from the SP to keep the attention of students. Once the relative number rises, the effect of social projects on free time priority change also increase, which means, students enjoy themselves in the SP more than usual, and start to spend more time in the SP and less time studying. As time priority is changed from studying to SP, the available capacity of the organization increases. Once the capacity has been adjusted to the full working capacity after the adjustment time, SP working capacity increases, which allows for a higher number of social projects. If the SP sees a drop in social projects, it decreases the relative number of social projects, which lowers the interest in the SP to its members, who change their priorities to other things, such as studying. This decreases fraction of free time spent in SP, which decreases the available capacity. After adjusting, the SP working capacity is decreased, which leads to a lower number of social projects, since people are less interested to work on them.
R4 (Social activity breeds support)	When the SP create academic projects, the relative number of them increases when compared to the amount that the administration desires. This increases the affinity for the SP, which increases their support after an adjustment time. With increased support, less stress is put on the SP to continue doing academic projects and more of the working capacity is put towards social projects. With an increased number of social projects, the relative number of social projects increases when comparing it to the amount expected of the SP to keep a regular number of members in the organization. This increases the total SP activity, which increases the effect of SP activity on students in SP, as more students see what the SP is doing. This increases the students in SP, which increases the available capacity. After the capacity adjustment time, the SP working capacity increases and the number of academic projects that can be created also increases. However, if the number of academic projects decrease, then the relative number of them also decreases, eventually to below what the administration

	expects of the SP. This lowers the affinity for the SP, which eventually lowers support. With lower support, the SP is motivated to complete more academic projects so that the administration doesn't get too annoyed. This lowers social projects prioritization, which lowers the number of social projects. This leads to a decreased relative number of social projects, leading to lower SP activity and a lower number of students in the SP. As there is less projects being made, students in SP decreases, decreasing the available capacity, which, after the adjustment time, decreases SP working capacity, decreasing the number of academic projects even further.
R5 (Support motivation)	As more academic projects are created, the relative number of academic projects based on what the administration expects increases as well, which increases affinity for the SP by the administration. The affinity only grows until the administration can devote no more resources to assist it. After an adjustment time, the support increases, with the SP noticing. As this support increases, social projects can now be prioritized more since the SP doesn't have to worry about pleasing the administration as much. As social projects are prioritized, the number of social projects increase, which increase the relative number of social projects as opposed to the expected amount for BAU conditions. This increases the effect that social projects have on the free time priority change of the members of the SP. As more time is spent making the SP a more sociable and likable place to be, more free time is devoted by the members to the SP rather than studying. As the free time spent in SP increases, this increases the available capacity of the SP. After an adjustment time, the SP working capacity is increased and used to work on more academic projects. However, if there is a decrease in academic projects, the same process can happen in reverse - the relative number of academic projects decrease, lowering the affinity and support for the SP, changing the project prioritization of the SP to create fewer social projects, because they feel pressure from the administration to work on more academic projects. As this happens, less social projects are created, which lowers the relative number of social projects, decreasing how much people want to spend their time in the SP. As free time spent in SP decreases (through change in SP priority over studying, meaning, that the spare time is allocated to studying), this decreases the available capacity, which decreases the SP working capacity after an adjustment time, which further decreases the number of academic projects that are created.
R6 (Support increases academics)	With an increasing number of academic projects, the number of relative academic projects also increases, as it overshoots what is expected of the SP. This increases the administration's affinity for the SP, increasing support after an adjustment time. With an increase in support, the available capacity of the SP increases, as funds and help from the administration expedites processes and lets the SP afford more resources for projects. This, after an adjustment time, increases the working SP capacity, increasing again the number of academic projects. However, if the number of academic projects decreases, the relative number of them, compared to what is expected, also decreases. This causes affinity for the

	SP to drop, decreasing the support that the administration gives the SP after the adjustment time. This decreases available capacity, as more hurdles are put in front of the SP, and they are left with limited resources. This decreases working capacity, leading to even less academic projects being created.
R7 (Shortfall from social)	If ever the number of social projects drops, it decreases the relative number of social projects compared to what is expected of the SP. This decreases total SP activity, leading to less students being interested in joining the SP. As students in SP decrease, relative students in SP also decrease compared to the optimal amount. This decreases the shortfall mitigation due to a low number of members causing organizational difficulties within the SP. This causes the available capacity to decrease, decreasing working capacity after an adjustment time, leading to even less social projects. But if social projects increase, their relative number increases, increasing total SP activity. This means more students notice the SP and decide to join. This increasing effect leads to more students in the SP, leading the relative students to increase as well. This increases shortfall mitigation, bringing member numbers closer to the optimal amount, leading to higher available capacity, which increases SP working capacity and leads to more social projects.
R8 (Shortfall from academics)	If the number of academic projects decrease, it causes a decrease in the relative number of academic projects with respect to the expected amount. This causes a decrease in total SP activity, decreasing the effect of SP activity on students in SP, meaning, that a less active SP draws less students to it. This leads to a decrease in students in SP, leading to a decreased relative number of students in SP when compared to the optimal amount. This causes a decrease in shortfall mitigation, as there are not enough students to manage all the parts of the organization. This causes a decrease in available capacity and working capacity after an adjustment time, leading to even less academic projects. On the other hand, if academic projects begin to increase, the relative number of academic projects increases above the expected levels, causing an increase in total SP activity. This increases the effect of SP activity on the students in SP, drawing more people to it. This increases the students in SP or its members, causing an increase in relative students in SP when comparing the number to the optimal amount. This leads to shortfall mitigation increasing, as more members lead to less problems with managing the moving parts of the SP. This increases the available capacity, the working capacity as well, and leads to more academic projects.
R9 (Shortfall from support)	If academic projects decrease, it causes a decrease in the relative number of academic projects with respect to what is expected from the SP. This causes a decrease in the administration's affinity for the SP, which eventually leads to a decrease in support given to SP. A decrease in support means that the SP will begin prioritizing social projects less in order to win back the favor of the administration. Lower social project prioritization leads to a lower number of social projects as well as a lower relative number of them, as there are expectations from the SP on how much they should create. This causes a

	decrease in SP activity, leading to less students being interested in working for the SP. As students in SP lower, this lowers the relative number of students in SP, causing lower shortfall mitigation which leads to a lowered available capacity, as there are not enough students to complete all of the duties needed for the SP and more time needs to be spent filling in the jobs not directly involving projects. This eventually leads to a lower working capacity and a further decreased number of academic projects. However, if academic projects increase, this increases their relative numbers, causing a rise in affinity and support for the SP, which leads to less stress and more opportunities to prioritize social projects. With the change in prioritization, more social projects are created, which increases the relative number of social projects above what is expected, increasing total SP activity above the norm, which affects how many students join the SP. The students in SP increase, leading to a higher number of relative students in SP when comparing to the optimal amount. This then increases shortfall mitigation as the necessary jobs are completed by the members, allowing the SP to work at full potential. This increases available capacity, working capacity, which leads to more academic projects.
B1 (Limit capacity change)	As the SP working capacity increases, the gap between actual and available capacity decreases, meaning, that less capacity can increase in the next time step.
B2 (Limit support change)	As more support is given to the SP by the administration, there is less of a difference between the support given and the affinity at a given time, meaning, that less support can be given in the next time period as the gap decreases.
B3 (Limit SP devotion)	As a larger fraction of free time is spent in SP, less total free time is available, therefor, less time can be changed from studying to the SP.
B4 (Limit study sacrifice)	As more time is taken away from studying to spend in the SP, less time remains in studying, so less time can be moved to SP.
B5 (Support checks priorities)	When social projects are prioritized more, they produce a fewer number of academic projects done by the SP. With fewer projects, the relative number of academic projects to the desired amount by the administration decreases as well. This decreases the administration's affinity for the SP, but only to a certain point, below which they cannot be any more disappointed in the SP, as they require the SP as an organization even if it doesn't perform how they want it to. As affinity decreases, the change in support decreases, which decreases support given to SP after the support adjustment time in which the administration contemplates whether or not the SP is just having a bad month due to outside forces or is intentionally lowering effort in academic projects. When the support decreases, the SP takes notice and begins prioritizing social projects less and academic projects more in order to not lose the trust of the administration. As the SP increases prioritization of academic projects, the same process happens

	but in reverse - number of academic projects begin to close the goal which increases affinity, which, after an adjustment time, is noticed by the SP as increased support. As the affinity increases, the SP moves prioritization back to their favored type of projects - social projects, since they are not scrutinized as much by the administration more and can afford to relax.
B6 (Grade motivation)	As more free time is spent studying, the difference between actual and normal time studying increases, which leads to an increase in average grades. This increases the free time priority change towards spending more time in the SP, since students reach over the grades they normally expect and do not feel the stress of their studies failing. This decreases the fraction of free time spent studying, which eventually decreases the difference between actual and normal studying time. As this difference decreases, average grades begin to drop. Once they drop below wanted levels, students understand that studying and staying in the university is more important than work in the SP at that time, so the effect of average grades on free time priority change decreases, decreasing the amount of time spent in SP, and increasing the time spent studying.
B7 (Saturation from social)	As the SP creates social projects, the relative number of them increases compared to what is expected of the SP. This increases the total SP activity, which is noticed by the university students. This increases the effect of SP activity on students in SP, and more students join the organization. As more students join the SP, the relative students in SP compared to the optimal number of students increases, which causes a decrease of saturation mitigation. This means that there are more members in the SP than the organizational structure of it can sustain, which causes issues when organizing projects. This decreases the available capacity of the SP. After an adjustment time, SP working capacity decreases, leading to less social projects, which can eventually lead to a decrease in total SP activity as the relative amount of them drops below the expected amount. If this happens, total SP activity decreases and less students are motivated to join the SP through the effect of SP activity on students in SP. As less students join the SP, the relative amount of them compared to the optimal amount also decreases, which increases saturation mitigation. This increases available capacity, as the members of the SP do not have to deal with the consequences of too many members. This now increases the working capacity of the SP, as it works more efficiently than before, once again increasing the number of social projects they can create.
B8 (Saturation from academics)	As academic projects are created, the relative number of them increases, as more are completed than normally expected. This causes an increase in total SP activity, which increases the effect of SP activity compared to the normal activity on students in SP. This increase the number of students in SP, increasing the relative amount of students compared to the optimal amount. As it overshoots the optimal, it decreases saturation mitigation, as there are more members than can be handled. This decreases the available capacity of the SP, lowering the working capacity after an adjustment time when the new students are trained. With a lowered capacity, less academic projects can be made. This lowers the relative number of academic projects, lowering the total activity of

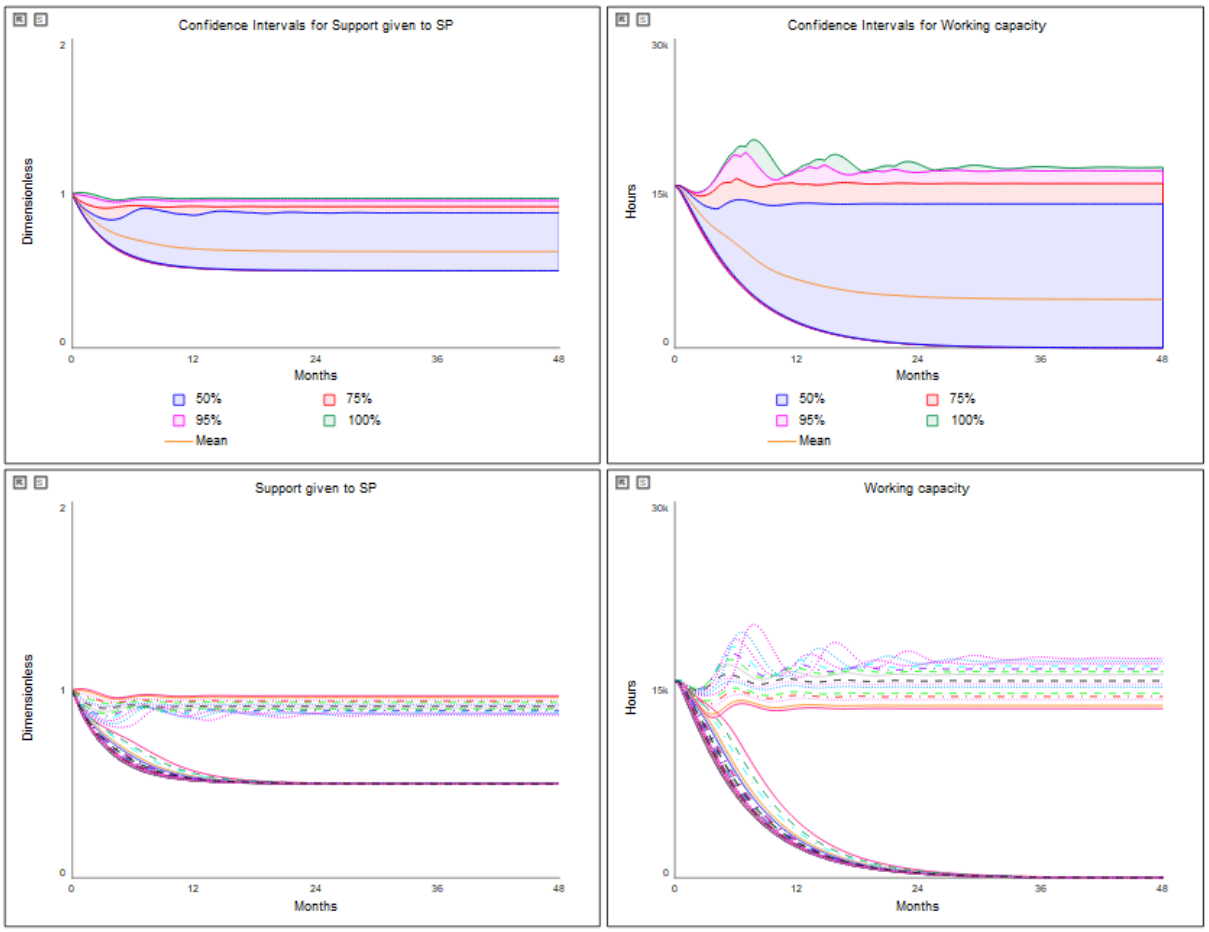
	the SP. This causes less students to be interested in the SP as it is less active than usual, decreasing students in SP. This decreases the relative students compared to the optimal amount, bringing the saturation mitigation back up. This causes an increase in available capacity, as there is less trouble with less members, leading to an increased working capacity and more academic projects being made.
B9 (Saturation from support)	When the number of academic projects increase, their relative number increases, closing or surpassing the goal desired from the administration. This increases the affinity of the administration for the SP, increasing support after an adjustment time. As support increases, the SP can worry less about academic projects and do more social projects, leading to an increased number of social projects and relative number of social projects with respect to the amount usually expected. This increases total SP activity, which increases the effect of SP activity on students in SP. As it becomes more active, the SP draws more students to it, increasing the member count. This also increases the relative students in SP, as the number of members reaches or overshoots the optimal students in SP. As this limit is reached, saturation mitigation decreases. It becomes increasingly harder to manage such a large number of members, which lowers the available capacity. This decreases the SP working capacity after the adjustment time, which then decreases the number of academic projects that can be created. This then leads to an eventual decrease of the relative number of academic projects, decreases the affinity and support that the SP receives, which leads to the SP social project prioritization decreasing. This decrease the number of social projects, eventually to below what is regularly expected, which decreases total SP activity. This decreases the effect of SP activity on students, which lowers the student count in the SP. With less members, the relative students in SP lowers, getting once again closer to the optimal amount, which increases saturation mitigation, which increases available capacity, as the extra students causing the saturation and issues leave the organization, letting it work at its full potential. This increases the working capacity after the adjustment time, which again increases the number of academic projects that are made.

APPENDIX C: SENSITIVITY ANALYSIS

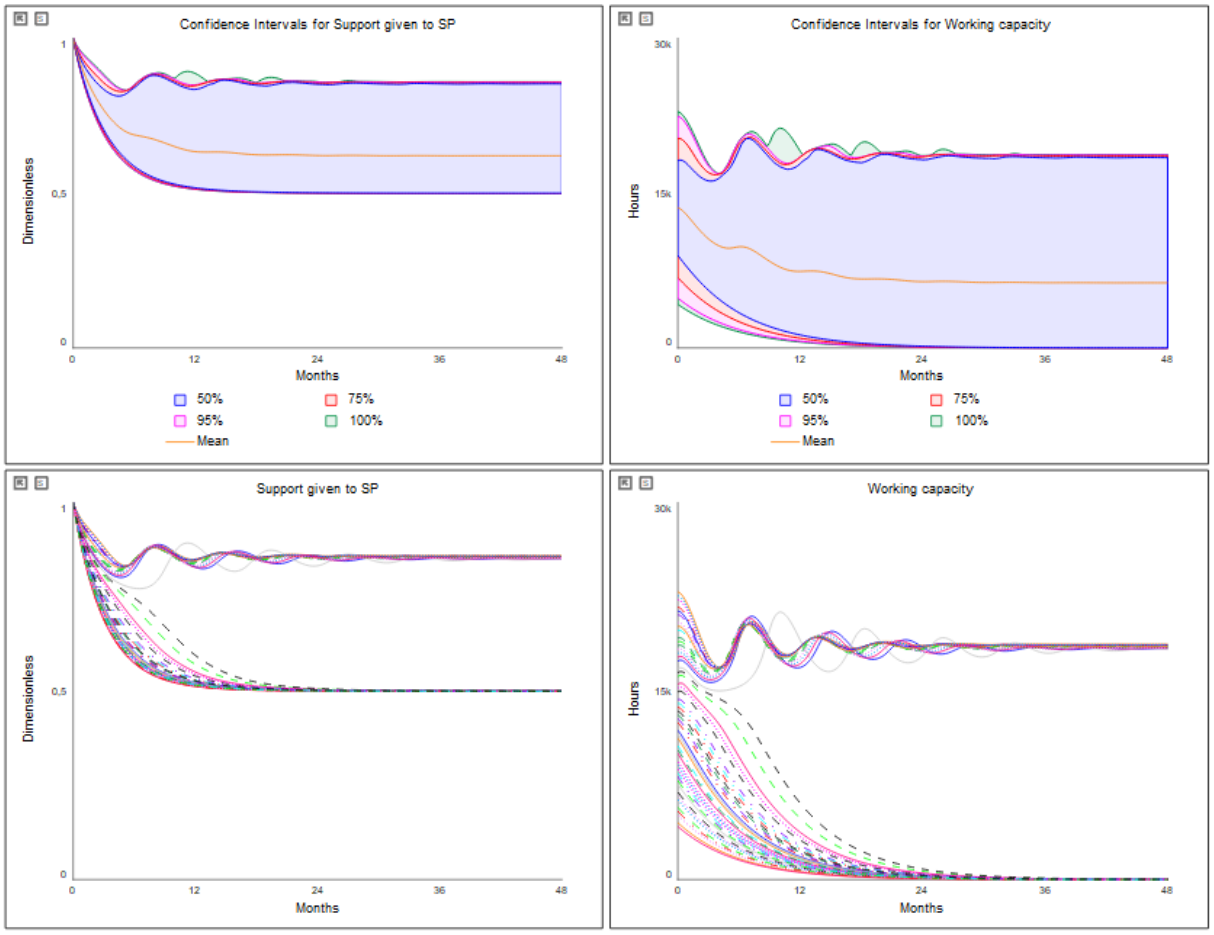
The behavior graphs of the working capacity and support given to SP with variables determined to be behaviorally sensitive are displayed here in the order presented in the summary in table 3.

Each variable determined to be realistically possible at a different value was tested for sensitivity. Each sensitivity test was conducted with 50 runs, testing each variable one by one with a uniform distribution across a set range deemed appropriate judging by personal experience or assumed after deliberation. Each test yielded results for working capacity and support given to SP in the form of confidence interval graphs that show probability distribution of the runs and behavior graphs that show the different behavioral modes achievable.

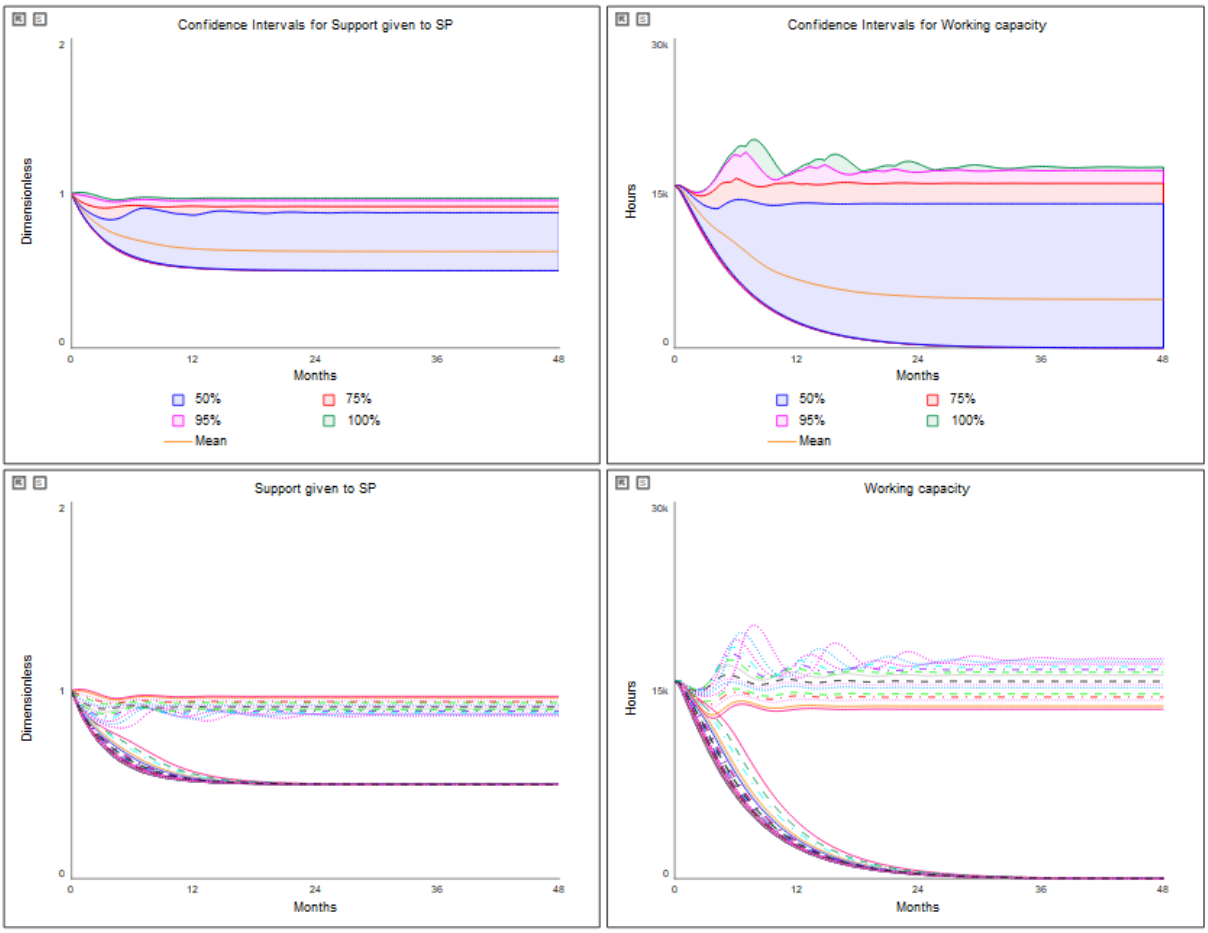
Normal effort for one academic project



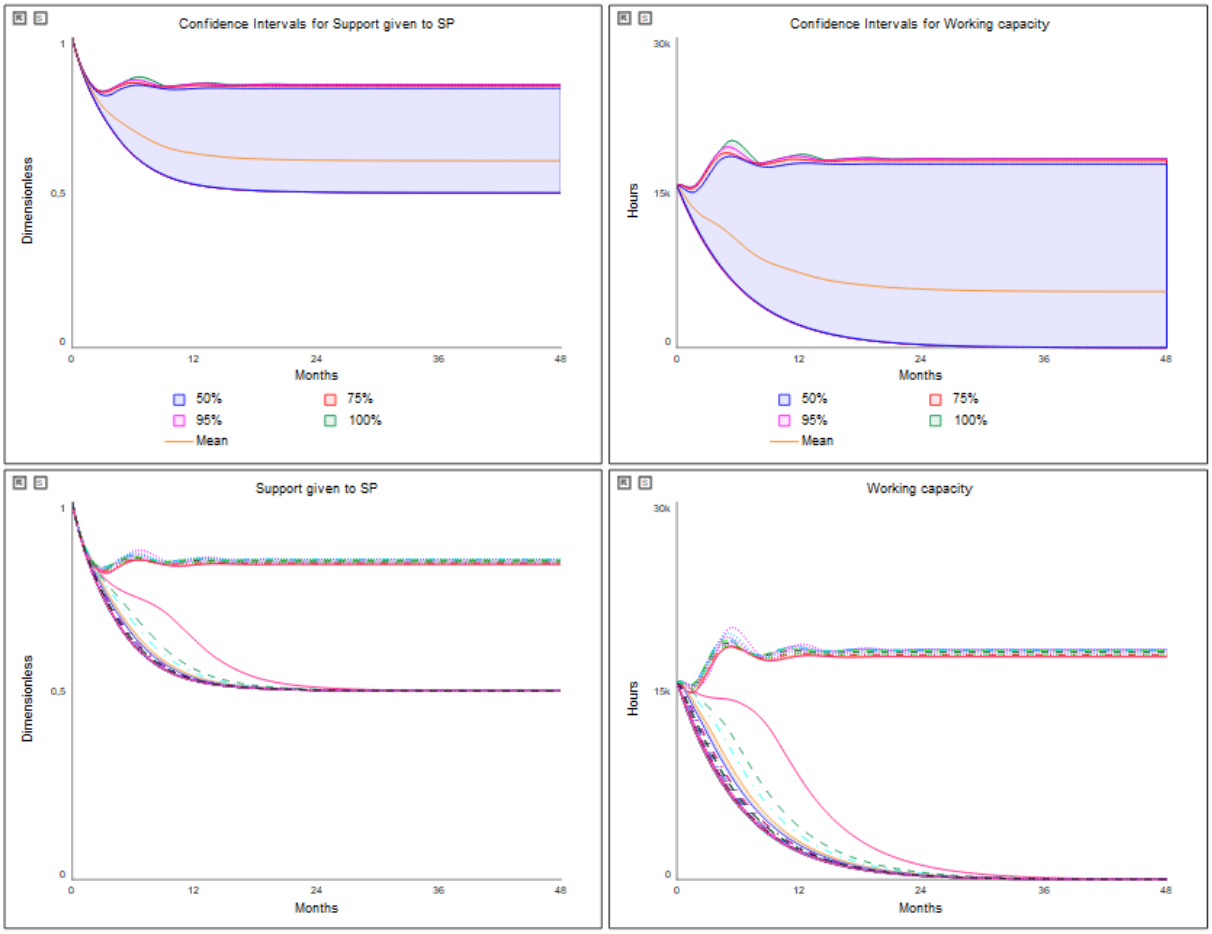
Disposable hours per month



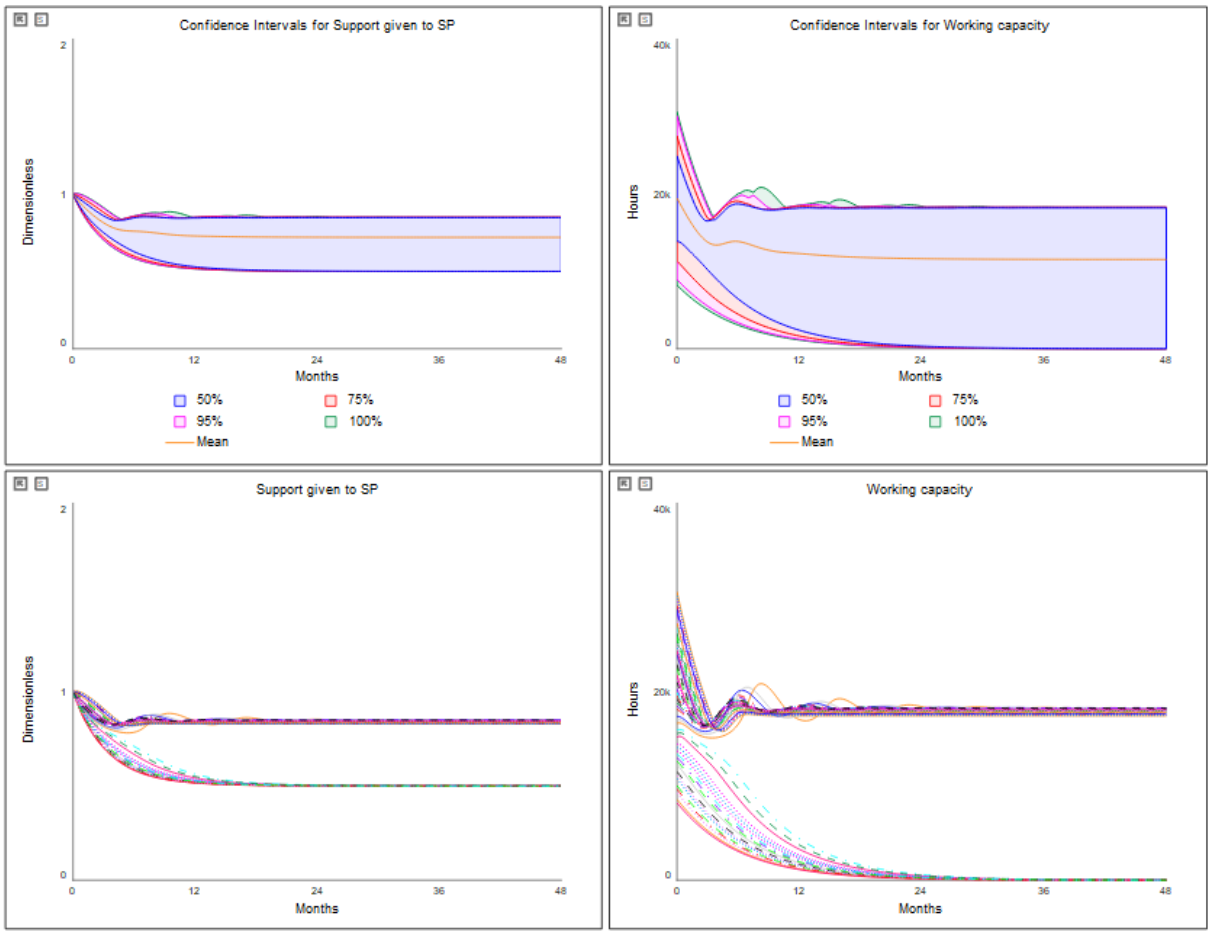
Expected academic projects



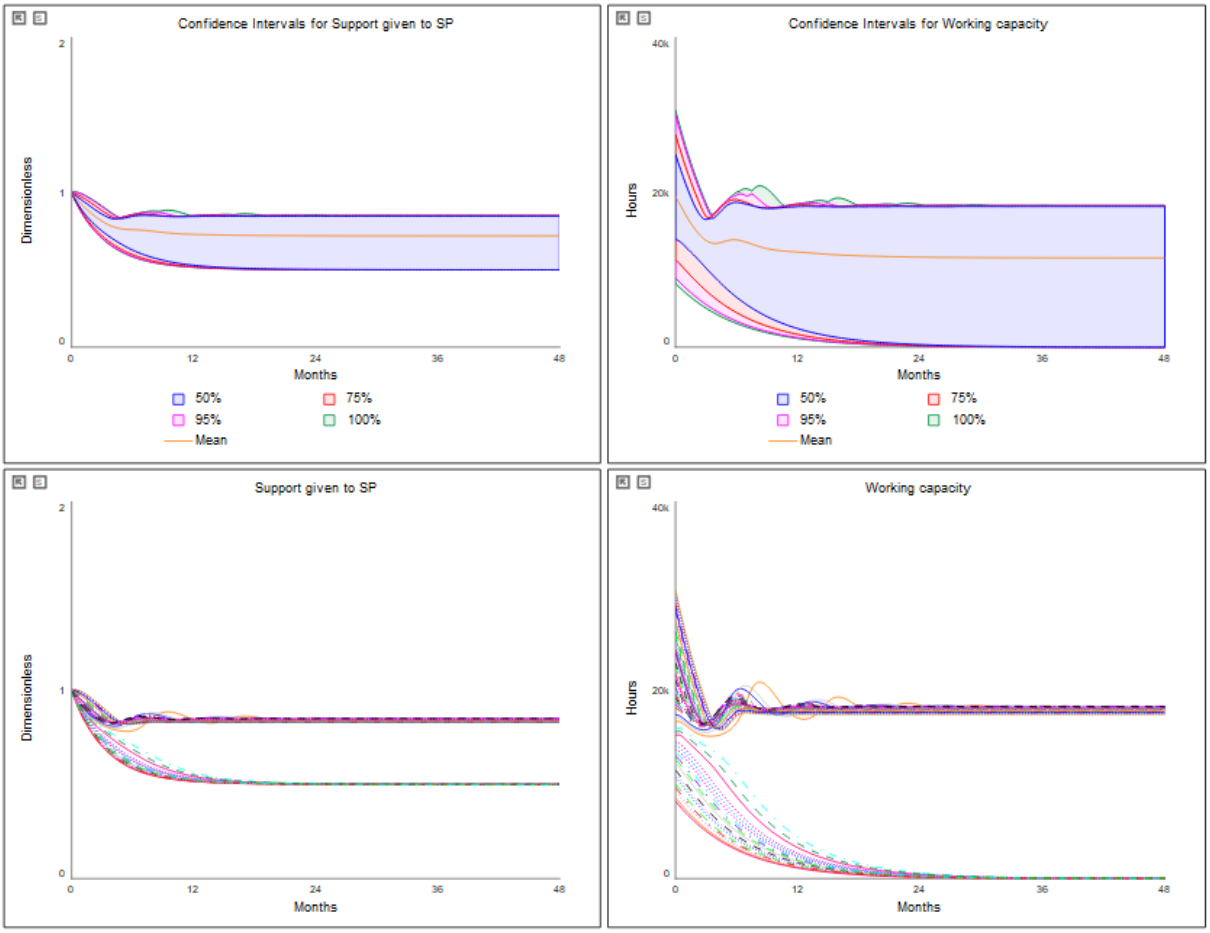
Normal SP activity



Number of students



Normal fraction of active students in SP



Optimal students in SP