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A SIMULATOR SUPPORTING THE DISTRIBUTION OF THE PRIMARY SUBSIDY IN A FACULTY AT WROCŁAW UNIVERSITY OF TECHNOLOGY

Chosen aspects of a simulator supporting the distribution of the primary teaching subsidy in a faculty of Wroclaw University of Technology have been presented. The mathematical equations forming the basis for the algorithm have been analyzed. The general premises of adapting the set of teaching duties within a faculty to this model have been formulated. Various scenarios illustrating how the distribution of this subsidy works in practice have been shown. Introductory results of such simulations (using MS EXCEL) for a chosen scenario have been presented and discussed.

Keywords: *algorithm for subsidy distribution, simulator*

1. Introduction

Despite the changes that have been taking place for a dozen or so years in higher education in Poland, the main source of revenue for the faculties of a public college or university still remains the primary intramural teaching subsidy denoted in Fig. 1 as *Dw* (called primary subsidy).

To determine the appropriate funding for a public college/university, an algorithm for the distribution of ministerial subsidies is applied [2]. In colleges/universities, the distribution of subsidies to individual faculties is carried out by applying identical or very similar rules to those implemented at the ministry level, and also use IT. However, the distribution of a subsidy within a faculty unit, for example between departments, is

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often done intuitively, arbitrarily without IT support. In consequence, the final distribution creates not only the need for a unit to report income effectiveness but often decides about its survival. This does not always happen in accordance with the need for the unit to participate in improving the values of the faculty's key performance indicators (KPIs). The history of these KPI components are commonly stored in global information systems (for example, in the POLon system), which are automatically supplied from operational systems (for example USOS, JSOS, etc.). Therefore, the results of such reporting are permanently saved as information about a unit's budgets in the ministerial data warehouse. This results in the importance of algorithms for distributing the primary subsidy and interest in them as a research subject, their implementation via IT and at different levels of college management. Owing to the dynamic character of a unit's budgeting processes, it is assumed that a simulator of the subsystem for distributing a faculty's primary subsidy will be an appropriate support tool for budget decisions. The development and application of such a tool for the Faculty of Computer Science and Management is a broad research project, a part of which this paper describes.

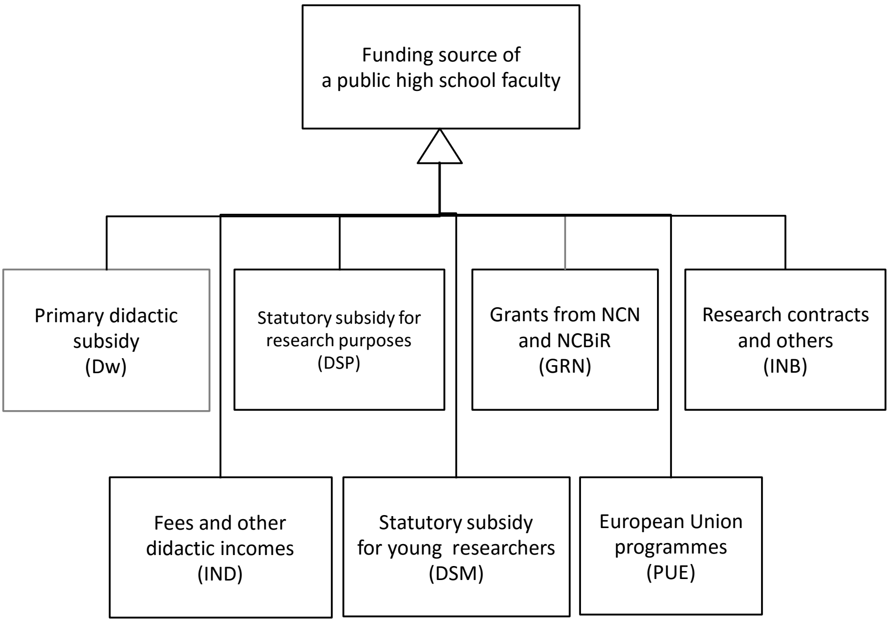

Fig. 1. Sources of funding of a public high school faculty (on the basis of [8])

Achieving this goal is especially important because at present, in 2015, the inadequacies of the algorithm for distributing the primary subsidy are being observed for the first time, both at the university level and at the level of faculties within Wrocław University of Technology [15]. It is difficult to use the results of earlier work [10–12]. Therefore, the scope of the studies in this paper includes: (i) a description of the faculty's new algorithm, (ii) formulating the assumptions of the simulation model and its implementation and (iii) presentation of initial results on the effects of the distribution of the primary subsidy obtained using such a simulation.

2. Algorithm for subsidy distribution

2.1. Algorithms applied by the Ministry of Science and Higher Education

Controlling the parameters of the stream of subsidies designated to the teaching activities of public universities has a history of almost thirty years [6]. The formula used in this process has always composed of two components defining a unit's level of funding. The first component is based on the subsidy awarded in the previous year and the second on the basis of a multi-dimensional function assessing the unit's usefulness. The first (the carried forward part of the subsidy) is given a weight of 0.7 in determining the level of the assigned subsidy. The second weight (given to the assessment of a unit's usefulness) equals 0.3 and determines how the level of the subsidy varies from year to year. Its components, as defined in 2013, are shown in Fig. 2.

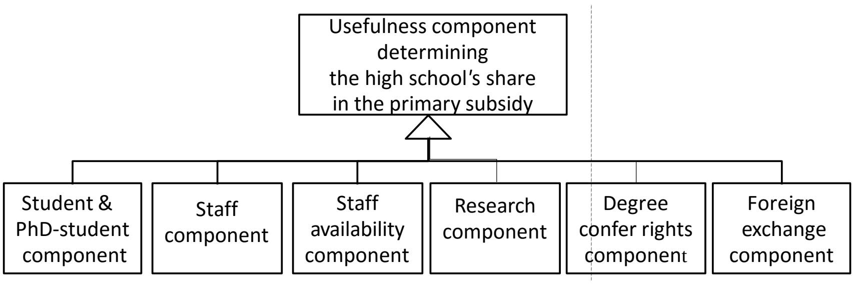

Fig. 2. Components determining the usefulness of a unit, used since 2013 in the formula defining the primary subsidy (on the basis of [8])

The measure of the usefulness of a high school unit has always included the following two dimensions: student and PhD-student and scientific staff. The student and PhD--student component has always depended on the number of students weighted by a cost-intensiveness coefficient for each field of study. The staff component has been determined by a weighted, according to academic rank, sum of the number of full-time academic teachers. The total influence of these two components on the measure of a unit's usefulness has always been at least 65%.

Other dimensions, which have less influence on the measure of a unit’s usefulness, have been applied since 2007. Among the controversial aspects of the algorithm’s application, one may highlight the following (compare [1, 6, 13]): the high value of the weight of the carried forward part of the subsidy (0.7), inappropriate values of the cost-intensiveness coefficients for the fields of study, redundancy of the dimensions in measuring usefulness, and the interesting problem of inconsistencies which appear when such algorithms are applied at different managerial levels within higher education.

2.2. An algorithm for distributing the primary didactic subsidy in a faculty of Wroclaw University of Technology

The algorithm for the distribution of the didactic subsidy among faculty units is based on a projection of the functioning of organizational units onto the areas shown in Fig. 3. An organizational unit is entitled to receive a subsidy when it is involved in performing the three following fundamental tasks:

- teaching within the mother faculty,
- educating scientific staff,
- conducting research.

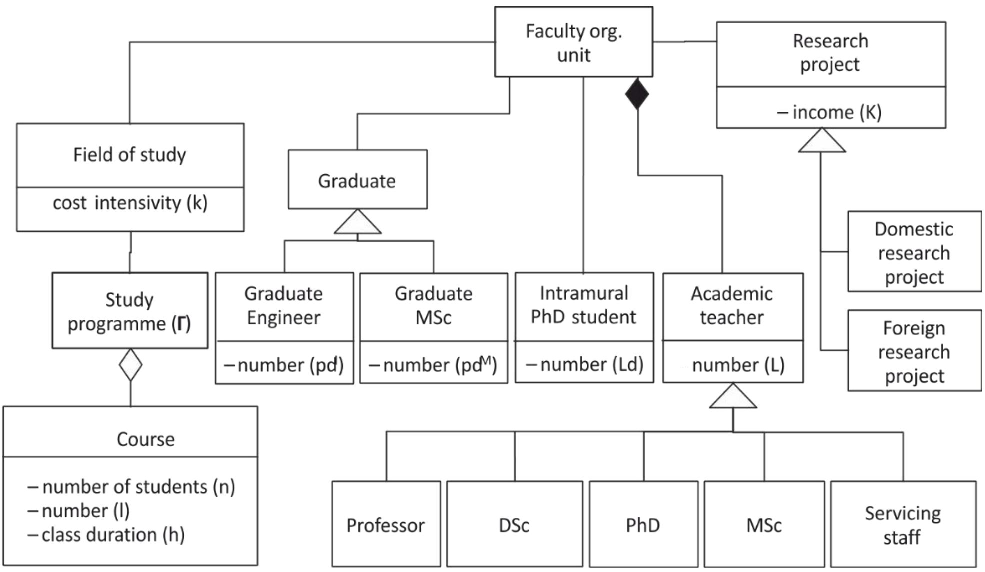

Fig. 3. Factors taken into consideration in the distribution of the primary subsidy among the organizational units of a faculty

Teaching consists of running courses in accordance with the study programs offered by the mother faculty. Each field of study possesses a certain cost-intensivity, which is taken into consideration when dividing the subsidy. Courses run by teachers have a strictly defined duration and number of participants.

The second component of teaching activities is the graduation of engineers and masters of science, which is characterized by the number of graduates. The number of non-engineering bachelor degrees is not taken into account. Research activity is characterized by the amount of income obtained from research projects financed by domestic and foreign institutions.

An organizational unit of a faculty has a defined teaching staff potential, known as the staff component, which is also taken into consideration in the distribution of the subsidy. The staff component is characterized by the weighted sum of the number of academic teachers, where the weights depend on their scientific titles/degrees: professor, doctor of science, doctor of philosophy, master of science, as well as the number of teaching service staff employed in the organization.

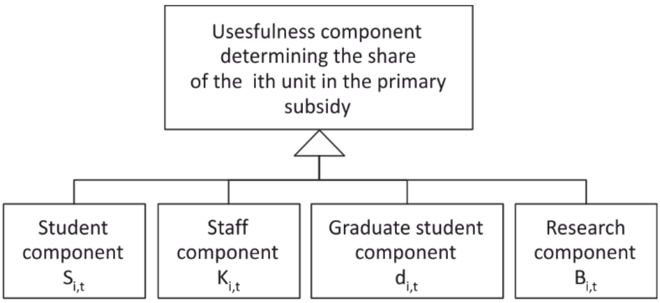

Fig. 4. Components defining the usefulness of a unit in determining the share of the *i*-th unit in the primary subsidy

The algorithm for distributing the subsidy assesses organizational units using four criteria (see. Fig. 4): the labor-intensiveness of teaching (student component), employment structure (staff component), participation in training future staff (the graduate student component), as well as income from research activities (research component).

The formalization of the algorithm for distributing the primary subsidy among faculty units can be described by using the directive of the Rector of Wrocław University of Technology [15] and the description of the ministry's algorithm [10], which is given by Eqs. (1)–(7). The basic formula for the distribution of subsidies is given by equations:

$$Dw_t = (1-\alpha_t)Do_t = Do_t - R_t \tag{1}$$

$$DJ_{i,t} = \left[0.7\frac{DJ_{i,t-1}}{Dw_{t-1}} + 0.3\left(0.45S_{i,t} + 0.35K_{i,t} + 0.1d_{i,t} + 0.1B_{i,t}\right)\right]Dw_t \tag{2}$$

where: t – the year of the subsidy's allocation[2], Dw_t – the subsidy to be actually distributed among the faculty units, Do_t – the subsidy awarded to a faculty, R_t – the reserve – the part of the subsidy designed to cover the costs incurred in the running of the faculty itself, α_t – the indirect cost rate for a faculty, i – the number of a faculty unit, $DJ_{i,t}$ – the subsidy granted to the i-th unit, $S_{i,t}$ – the student component for the i-th unit (intramural study), $K_{i,t}$ – the staff component for the i-th unit, $d_{i,t}$ – the graduate student component for the i-th unit (intramural study), $B_{i,t}$ – the research component for the i-th unit.

The subsidy to a faculty unit ($DJ_{i,t}$) is calculated as a proportion of the subsidy awarded to the faculty (Dw_t) using the participation indicator given by the expression placed in the square brackets in Eq. (2). This indicator is the weighted average of two expressions with weights 0.7 and 0.3, respectively. The first expression describes the participation of the i-th unit in the subsidy in the previous year and the second is a weighted sum of the unit's share in the four-dimensional function used to assess their usefulness[3]. The components of this multi-criteria assessment are: weighted sum of the number of intramural students ($S_{i,t}$), staff potential measured as a weighted sum of the number of the academic staff ($K_{i,t}$), number of graduate students taught ($d_{i,t}$), as well as research activity ($B_{i,t}$). The detailed formalization of these four dimensions is given in Eqs. (4)–(7), whose description is simplified by applying the participation function described by formula (3):

$$u(e_i, m) = \frac{e_i}{\sum_{j=1}^{m} e_i} \tag{3}$$

where: m – number of faculty units, $u(e_i, m)$ – participation function of a component defined for the i-th unit in a sum of m components.

A crucial factor, having a 45% influence, is the participation of a unit in teaching students. This is measured (Eq. (4)) by the number of student-hours of teaching for the courses run ($l_{j,s,t}$), the number of undergraduates $(pd^{I}_{j,s,t})$ and the number of masters of science students $(pd^{M}_{j,s,t})$. In the calculation of the resulting labor-intensiveness, the cost-intensiveness coefficient ($k_{s,t}$), as well as the unit's current labor-intensiveness in these areas: $h^{Z}_{j,s,t}$, $h^{I}_{j,s,t}$, $h^{M}_{j,s,t}$, are taken into account. It should be noted that Eq. (5) expresses a preference for small class sizes. The assumed marginal effect of an extra student on the total labor-intensiveness of a course (measured in student-hours) decreases when the number of students reaches 15 (below this number, the marginal effect is 1, but above, it is equal to 0.3). For example, assuming for simplicity that $k_{s,t} = 1$ and for

[2]In the description of variables with the subscript t the clause in the t-th budged year is omitted.
[3]The definition of this usefulness function differs significantly from the ministerial algorithm.

laboratories and lectures that $h^Z_{j,s,t}$ equals 30 hours/semester, the total labor-intensiveness of 10 laboratory groups with 15 students will be 4500 student-hours/semester. However, the lecture labor-intensiveness resulting from the same number of students in one group will be 1665 student-hours/semester, i.e. about 37% of the nominal labor-intensiveness.

$$S_{i,t} = u\left(\sum_{s=1}^{xs} k_{s,t} \sum_{j=1}^{kur_s} l_{j,s,t}\, h^Z_{j,s,t} + 8\sum_{s=1}^{xs} k_{s,t}\; pd^I_{i,s,t}\, h^I_{s,t} + 8\sum_{s=1}^{xs} k_{s,t}\; pd^M_{i,s,t}\, h^M_{s,t};\, m \right) \tag{4}$$

$$l_{j,s,t} = \begin{cases} n_{j,s,t} & \text{when} \quad n_{j,s,t} \le 15 \\ 15 + 0.3(n_{j,s,t} - 15) & \text{when} \quad n_{j,s,t} > 15 \end{cases} \tag{5}$$

where: xs – number of fields of intramural study with the same the cost-intensiveness coefficient, in which the faculty runs classes, $k_{s,t}$ – cost-intensiveness coefficient of the s-th field of study, kur_s – total number of courses in intramural studies from the s-th field of study (irrespective of the forms of classes and the level of study) run in the t-th year by employees and graduate students of the i-th unit and other persons, to whom this unit entrusted classes, $l_{j,s,t}$ – intensity of the j-th course in a field of study with $k_{s,t}$, this excludes those students retaking the course, $h^Z_{j,s,t}$ – duration of the j-th course in the field of study with $k_{s,t}$, this duration is calculated as the product of the number of hours per week and the number of weeks the course runs for, $pd^I_{j,s,t}$ – number of undergraduates (excluding graduates retaking a diploma course) of intramural studies of the i-th unit in a field of study with $k_{s,t}$, $pd^M_{j,s,t}$ – number of masters of science students (excluding those retaking a diploma course) of intramural studies of the i-th unit in a field of study with $k_{s,t}$, $h^I_{s,t}$ – number of teaching hours assigned by the faculty board to supervisors of intramural undergraduates in a field of study with $k_{s,t}$, $h^M_{s,t}$ – number of teaching hours assigned by the faculty board to supervisors of intramural masters of science students in a field of study with $k_{s,t}$, $n_{j,s,t}$ – number of students of the j-th course in a field of study with $k_{s,t}$, excluding students retaking a course.

The second most significant factor, having a weight of 35% in determining the measure of a unit's usefulness, is the score describing the potential of its teaching and research staff expressed by the following formula:

$$K_{i,t} = u\left(2.5L_{\text{prof},\,i,t} + 2.0L_{\text{dr\_hab},i,t} + 1.5L_{\text{dr},\,i,t} + 1.0L_{\text{mgr},\,i,t} + 0.7L_{\text{dyd},\,i,t};\, m\right), \tag{6}$$

where: $L_{\text{prof},i,t}$, $L_{\text{dr\_hab},i,t}$, $L_{\text{dr},i,t}$, $L_{\text{mgr},i,t}$, $L_{\text{dyd},i,t}$ – number of full-time: titular professors, doctors of science, PhDs, MScs and teaching service staff, respectively, employed by the i-th unit.

The other two components of the usefulness function: graduate student education and research potential, are described by:

$$d_{i,t} = u(L_{d,\,i,t}; m) \tag{7}$$

$$B_{i,t} = u(K_{G\_\text{domestic},i,t} + K_{G\_\text{foreign},\,i,t};\ m) \tag{8}$$

where: $L_{d,i,t}$ – number of intramural graduate students in the i-th unit, $K_{G\_\text{domestic},i,t}$, $K_{G\_\text{foreign},i,t}$ – incomes from research projects financed by domestic and foreign (including international programs) institutions respectively, gained by the i-th unit in the previous year.

3. Aims and assumptions in the implementation of the simulator

3.1. Goals, problems and decisions in the context of the algorithm at the level of faculty management

The revenue of a unit ($DJ_{i,t}$) changes dynamically year by year and depends on the values of the variables describing the unit (Eqs. (1)–(8)). For an analysis of this class of economic processes[4], models based on a system of first degree differential equation (see [7], p. 81–82) are sufficient.

Such models are implemented as simulators with segmented structures:

$$\begin{aligned} &\varTheta\ =\ (T, E,\ \varOmega,\ Q,\ Y,\ \delta,\ \lambda), \quad E = X \cup Q, \quad D \subseteq X \\ &\delta : Q \times \varOmega \to Q, \quad \lambda : Q \times \varOmega \to Y \end{aligned} \tag{9}$$

where: E – space of the values of exogenous variables containing the values of input variables (X), including decision variables (D), $\varOmega$ – set of input segments, e.g., $\varOmega = (X, T)$, which contains decision segments (D, T), Q – space of the state variables, Y – space of the output variables (observed), δ – vector state transition function, λ – vector output function.

The basic problem of constructing such a simulator is conceptualizing the descriptive variables in the model. It is possible to use ontologies (knowledge about a faculty acquired within the following framework: description of a problem, possible actions and their results) and make conclusions based on these ontologies (compare with, for example, [9], p. 93–104).

[4]For example, see [5, 7, 16].

Based on the structure given by Eq. (9), decision making is aided by an analysis of the associations between segments (time characteristics) of variables describing a situation in which a decision is made. The values of these variables are generated by the simulator. The goal of such a simulation is based on the goals of the decision maker, who must solve the decision problem defined by the situation resulting from the associations between descriptive variables (given by formulas, business rules). The goal of the decision maker is to understand the effect of not only the choice of the input, decision and output segments, but, above all, the choice of the output segments and the rules defining their dependency on the input segments. Thus, inferring the dependency (X, T) → (Y, T) given the decision variants (D, T) using, for example, the method of *ceteris paribus* gives the possibility of choosing the best adaptation of the segment (D, T) to the goal and, above all, the decision maker's understanding of the logic of the decision problem described by:

$$(Y,T)=\lambda\Big[\delta\big[(D,T);(\{X-D\},T)\big]\Big] \tag{10}$$

It is assumed that the simulator considered will aid a team of specialists headed by the Dean of Management and Finance (the main user) to control the budget.

3.2. The functions and assumptions in the implementation of the simulator

The set of functions of the simulator (cases in which it is used) may vary depending on the goals of the main user. The simulator should be a flexible aid in achieving these goals. Firstly, it should enable the user to resolve controversies surrounding the algorithm itself, as mentioned earlier. That is to say, based on a longer time horizon – what are the effects of the proportion of the subsidy carried forward on the distribution of the subsidy and in the shorter term, an analysis of the effect of the cost-intensiveness coefficients of the fields of study. The second of these aims may concern the application of different variants of the algorithm at different management levels of the university. This difficult analysis is connected with the necessity of adapting the algorithm for distributing the subsidy into a model simulating a hierarchically organized system. The third group of functions may adopt various WHAT-IF scenarios to see what effect they have on the distribution of subsidies. Some of the results elaborated in [12], p. 82–83 will be used.

Generally, the possible applications of the simulator will depend on the assumptions made in the development process. In the case presented, the components of the ontology of a faculty's teaching activities illustrated in Fig. 3 and Fig. 4, as well as the formalizations expressed in Eqs. (1)–(10), have been used. Besides this, the main assumptions of the simulation model are as follows:

• The faculty operates a study program Γ consisting of three fields of study ($xs = 3$) at both undergraduate and master of science levels.

• Teaching in these fields of study is conducted in accordance with study programs: $\Gamma_{1,t}$; $\Gamma_{2,t}$; $\Gamma_{3,t}$, e.g., $\Gamma = \Gamma_{1,t} \cup \Gamma_{2,t} \cup \Gamma_{3,t}$.

• Two of these fields of study are operated independently by two separate faculty units (university departments), e.g., $i \in \{1, 2\}$, and one field of study is operated by both university departments combined ($\Gamma_{3,t}$).

• The two fields of study run independently have significantly different cost-intensiveness coefficients ($k_1 \ll k_2$). However, the cost-intensiveness of the field of study run in common by the two departments lies between these coefficients: $k_1 < k_3 < k_2$.

• The study programs are realized using various forms of classes, such as: lectures, tutorials, seminars, projects and laboratories.

• The share $T_{i,t}$ of the i-th unit in the realization of study program Γ_t is calculated as the sum of the student-hours on all courses (and diploma dissertations) served by this unit, as given in Eq. (4).

• Each unit provides its own field of study ($\Gamma_{1,t}$, $\Gamma_{2,t}$) and its share in the common field of study ($\Gamma_{3,t}$) using the minimum number of academic staff.

• In all the fields of study, teaching service employees are employed at the faculty level, together with an administrative clerk, who supports the faculty dean.

• All decisions are undertaken at the faculty level.

• Basic budget decisions concern the value of the reserve (R_t) and the subsidies assigned: $DJ_{1,t}$ and $DJ_{2,t}$.

• The time horizon for simulation is at least 3 years ($t = \{1, 2, 3, \ldots\}$).

Based on the assumptions presented above, it may be possible to define various scenarios for simulations aimed to support decision making by the main user. Examples of such scenarios can be formalized as follows.

• Scenario φ_1 studies the association between a change ΔDw_t in the primary subsidy to the faculty adapted to a change in the number of students $\Delta l_{j,s,t}$ on study program Γ_t in all fields of study: $\Delta Dw_t = \varphi_1(\Delta l_{j,s}, \Gamma_t)$.

• Scenario φ_2 studies the association of the ratio $DJ_{1,t}/DJ_{2,t}$, i.e. between the shares of the units in the subsidy Dw_t, with the ratio $T_{1,t}/T_{2,t}$, i.e. between their workloads in the realization of their own study programs $\Gamma_{1,t}$ and $\Gamma_{2,t}$ according to the numbers of courses in both fields of study and fixed shares in the realization of program $\Gamma_{3,t}$, i.e.: $DJ_{1,t}/DJ_{2,t} = \varphi_2\ (T_{1,t}/T_{2,t}, \Gamma_{1,t}\,; \Gamma_{2,t})$.

• Scenario φ_3 studies the association of the ratio $DJ_{1,t}/DJ_{2,t}$, i.e. between the shares of the units in the subsidy Dw_t, with the ratio $T3_{1,t}/T3_{2,t}$, i.e. between their shares in the realization of the common program $\Gamma_{3,t}$, given set levels of teaching loads in the realization of the study programs $\Gamma_{1,t}$ and $\Gamma_{2,t}$, i.e., $DJ_{1,t}/DJ_{2,t} = \varphi_2(T3_{1,t}/T3_{2,t}; \Gamma_{3,t})$.

• Scenario φ_4 studies the sensitivity of an increase ΔDw_t in the primary subsidy to the faculty resulting from an increase Δk_1 in the cost-intensiveness of the cheaper field of study given an established study program Γ_t: $\Delta Dw_t = \varphi_4(\Delta k_1; \Gamma_t)$.

Some of the most important requirements for implementing such a simulator may be use of MS Excel[5], together with Visual Basic, for a prototype application, as well as a final simulator with links integrating the experimental environment with the faculty's information systems (the accounting system EdukacjaCl, POLon, etc.).

4. A prototype simulator for use in the analysis of chosen scenarios

An example of the use of a prototype simulator concerns scenario φ_1 for subsidy distribution. In accordance with φ_1, the dependence between an increase in the subsidy available for distribution, ΔDw_t, and the increase in the teaching load, $\Delta l_{j,s,t}$, will be studied. Understanding this dependency will enable solving a decision problem based on choosing the optimal numbers of students for different forms of classes. The conclusions from this study can be used to determine the distribution of the subsidy that best fits the planned salary costs in the faculty units. Taking into account the fact that this is only the initial stage of developing the simulator, some simplifying assumptions have to be made. Some of these are as follows:

• The dependency is studied statically (for fixed $t = t_0$).

• The output variables are the dynamics[6] of the units' (department 1 and department 2) shares in the subsidy and the dynamics of the number of full time jobs in the units.

• The cost-intensiveness coefficients of the fields of study run separately are k_1 = 1.5 and k_2 = 2.5. The cost-intensiveness of the jointly organized field of study k_3 is 2,

• The study program Γ_t of all the fields of study is fixed.

• The numbers of courses, forms of classes and students in all the fields of studies are identical (based on historical data).

• The number of academic teachers employed in the units is the minimum level required [3].

• The shares in the subsidy are calculated using the student component ($S_{i,t}$).

• The number of full-time teachers in the unit needed to realize program Γ_t is calculated based on the ratio of the total number of hours of courses to the weighted average of academic teachers' teaching loads.

[5]In the literature on this subject, one can find examples justifying the convenience of using MS Excel in developing a simulator, e.g., in defining problems, forecasting, building regression models and optimization [4], as well as directly in the decision making process using models from operational research, for example, in breakeven calculations and aggregate planning ([14], p. 7–8, 19–49].

[6]The dynamics of the variable x_t is calculated as follows: dynamics(x_t) = x_t/x_{t-1}.

• Tutorial classes have a maximum of 25 students, other classes, except lectures, have a maximum of 15 students.

• The maximum size of lecture groups, x, is allowed to vary over the set $x \in \{15, 30, 45, ..., 120\}$.

• In the calculation of the numbers of groups of a given form of class, an additional group is added in the case of a non-zero remainder after dividing the number of students by the maximum number of students in the given form of class.

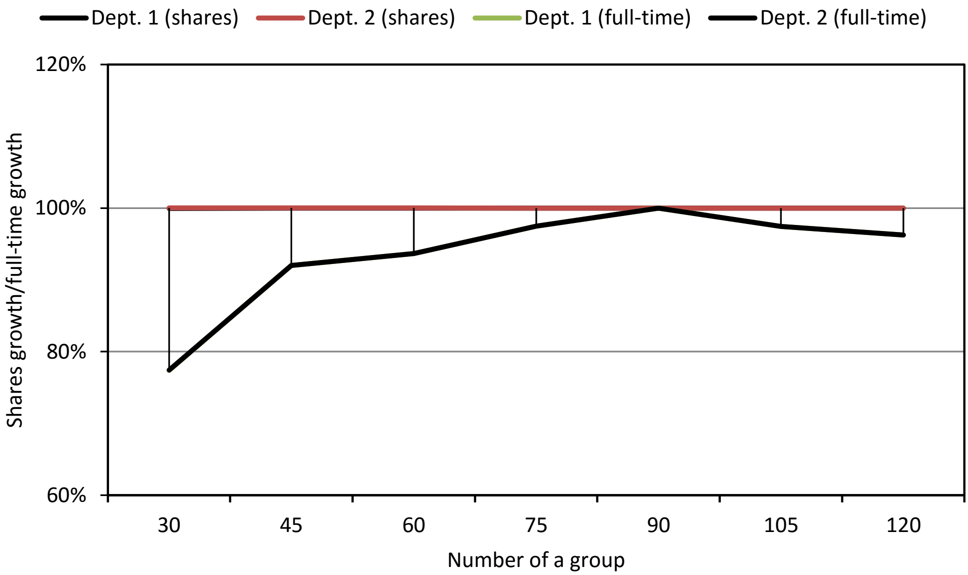

Fig. 5. The dynamic of shares in the subsidy and the number of full-time jobs depending on the number of students in a lecture group (the curves for department 1 are identical to those for department 2)

The results of the dynamics of shares in the subsidy based on an increase in the number of students in a lecture group is shown in Fig. 5. The percentages given are calculated with respect to the share or number of full time positions at the previous (smaller) maximum size of a lecture group.

The dynamics of the units' shares shows that in the scenario considered, a uniform increase in the size of lecture groups has no influence on their shares in the subsidy. Their initial values result from the cost-intensiveness of the fields of study considered. Under the assumptions made, including those regarding the cost-intensiveness, the initial structure of shares is 40/60. The 40% share is ascribed to the field of study with the smaller cost-intensiveness. This result confirms the correctness of the calculations.

Also, the dynamics of the number of full-time jobs in the units is as expected. Employment is non-increasing in the maximum size of lecture groups (the ratios are all less than or equal to 100%). The number of full-time positions required when the maximum size of the lecture group is 75 is the same as when the maximum size is 90. This dependency is identical for both units. This is consistent with the experimental assumptions that the data concerning the staff and fields of study served by the units are identical (except for the cost-intensiveness coefficient). Finally, the numbers of necessary full-time positions, calculated ex post, are the same.

5. Conclusion

The analysis presented in this paper allows us to make important and appropriate decisions at the faculty level, concerning the distribution of subsidies. The most important conclusions are as follows:

- The rules for allocating subsidies to units within a faculty are different from those being applied for allocating subsidies to different faculties.
- According to the algorithm, the number of non-engineering dissertations is not taken into account, despite their presence in the teaching programs.
- The cost-intensiveness coefficient for a field of study is used for all classes in that field, irrespective of the form of the class and the level of the program.
- For forms of classes which in practice have different labor-intensiveness (lectures, tutorials, laboratories), the labor-intensiveness calculated from the ministerial formula (according to the number of student-hours) increases faster than the sums of the numbers of student-hours. This effect is additionally multiplied by the cost-intensiveness coefficient, contrary to the intention of the legislator [2].
- The algorithm for calculating the number of student-hours favors class sizes of 15 and thus discriminates against lectures. Hence, the algorithm for assigning subsidies is not economically credible. In particular, it prevents balancing the smaller cost-intensiveness of a particular field of study by having a greater number of students in a class.
- In the faculty units, the algorithm for assigning the subsidy described in Chapters 2–5 of this paper, together with the conclusions above, lead to the transfer of funds from the field of study with the lowest cost-intensiveness to the unit servicing the field of study with the higher cost-intensiveness. However, the real costs are determined by the salaries of the academic teachers and the administrative staff. The decision maker can reduce this disharmony by undertaking the following measures: (i) creating financial reserves within a faculty with the intention of counteracting this phenomenon, (ii) increasing the number of student-hours in the less cost-intensive field of study and at same time decreasing the number of student-hours in the more cost-intensive field of study, (iii) deriving the optimal sizes of classes of different forms in all the fields of studies, as in the simulation analysis described in Chapter 4.

The use of a simulator in real decisions on budget allocation within a faculty is usually preceded by its verification, aspects of which are described in this paper. The resulting analysis of the effectiveness of budget variants might prove interesting. Such simulations could investigate, for example, the possibility of realizing a given study program by engaging a concrete level of funds (in particular, whether the funding is sufficient to cover the cost of employing the lecturers needed). This would improve management at faculty level. As a consequence, the allocation of public funds to institutes of higher education could improve.

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