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Abstract: Allocations of funding for higher education have typically focused on competition in neoliberal mechanisms. Surprisingly, much less attention has been paid to considering the effect of fund allocations for public goods purposes in neoliberal contexts. This study aims to examine specific funding schemes and determine the influential factors impacting the funding for teaching, research, and public goods intention. Taking Taiwan's Higher Education Sprout Project (HESP) as a unique example, we explored the effect of policy initiatives on public goods transformation. The data was collected from the Ministry of Education and Scopus database. First, the t-test and ANOVA were used to detect the differences between the system and sector; Second, regression analysis was used to determine influential factors for funding allocations; Final, structural equation modeling (SEM) was used to explore the causal effects among the selected variables. The study found that only diversity was shown in private technology groups receiving less HESP funding. The findings suggest that the funding allocation may not affect teaching and research based on sectors and systems. In contrast, this study demonstrates that transforming the public good through special funding can play a critical role in policy intention in neoliberal higher education.

Keywords: education policy; funding allocation; higher education; HESP; neoliberalism; public goods

1. Introduction

Over twenty years of scholarship on the neoliberalism of higher education have captured its features, such as the corporate university, the entrepreneurial university, and the neoliberal university [1,2]. In neoliberal contexts, funding allocations for higher education have typically focused on competitive mechanisms. While higher education has been funded directly by the state, it is usually seen as serving public goods, such as a reduction in inequality and an increase in social mobility. Therefore, related public goods policy initiatives seek to reframe higher education as interrelated with the well-being of society [3–5]. Several governments have adopted the format of a national strategy or development plan by setting out national objectives for better alignment with higher education institutes, for instance, Ireland, the Netherlands, Finland, and New Zealand [6]. On neoliberal campuses, it is overemphasized competition and evaluation. This phenomenon has caused numerous criticisms [7–10]. This study may stand at a turning point to provide a better understanding of the transformation from neoliberalism to public goods in higher education.

In addition, Eryaman & Schneider argue research associations can promote the use of research to service public goods [11]. Some nationwide or international associations have focused on this issue; for example, the Australian Association for Research in Education (AARE) identifies its vision of enhancing public goods by promoting, supporting, and improving research [12]; the American Educational Research Association (AERA) recognizes that promotion of research to serve the public goods as the fundamental responsibility of the association [13]. Based on the discussion, it has become a persistent issue that public resources transfer into higher education properly for public goods purposes. Surprisingly, much less attention has been paid to verifying the effect of the allocation of resources for public goods in higher education settings. This study provided an alternative way to

detect specific funding allocation for public goods purposes, which can gain a deeper understanding of this issue.

The funding policies in higher education are varied, for example, the UK has shown differently from those of Germany, Italy, and the United States. Even the similar higher education system in Japan and South Korea have specific considerations. Taiwan is part of a different socio-political constellation, based on and driven by different value sets than the neoliberal societies. Taking Taiwan's Higher Education Sprout Project (HESP) as an example, this study explores how far the specific funding allocation can be transferred with the public goods implemented in higher education. HESP (from 2018 to 2022 stage I) initiated in 2017, it intends to transfer public goods as a policy-driven tool for higher education institutes [14,15]. It is a different direction leading to higher education aligned with the policy. In this study, we argued that higher education for public goods purposes should consider balancing their teaching and research, caring for disadvantaged students to increase social mobility, and balancing global competition and local needs in terms of fulfilling university social responsibility. It also that the higher education system can be expected to sustainable development under the specific funding allocation mechanism.

We wonder when the funding allocation for public goods in neoliberal higher education will happen. This study, focusing on specific policy implementation, can provide an example for enhancing knowledge in this field. With this purpose in mind, this paper proceeds as follows: First, we review funding allocation theories, meanings of public goods, and their transformation logic in higher education. Meanwhile, the focus will be on the policy initiative of HESP as an example of seeking for public goods. Second, the method section will address the data collection and statistical processes conducted to verify the logic of funding allocation. Third, the effect of funding allocation in HESP will be examined with different types of higher education institutes and their structural relationships. Fourth, the discussions will focus on what challenges are confronted in the higher education system when the public goods policy is intended to be implemented. Finally, conclusions will be drawn and suggestions will be provided for higher education.

This study demonstrates that transforming the public good through special funding can play a critical role in neoliberal higher education regardless the sectors. If the transformation model- ITO (input, transform, and outcome) works well, it implies that the public goods initiatives can be implemented in higher education. The findings may encourage that higher education institutes commit to achieving great progress in expanding learning opportunities for all, as UNESCO's SDGs propose in higher education. With fitting funding for public good purposes, higher education can find ways to respond to the challenges of local and global issues.

2. Literature Review

2.1. Theory of Funding Allocation

Funding allocation refers to a process in which a system or a government transfers resources among the various intended activities its aims will achieve. There are various funding allocation theories, and the evidence-based model is one of them to ensure that funding is invested in the target groups of the greatest need [16]. Management theory is primarily devoted to planning and budgeting for the use of resources [17]. The resource allocation process is assumed to be an exemplary process for theory-based instruction to guide the choices of management. Planning theory has seen management as providing aggregate goals integrated into sub-goals for each part of the organization [18,19].

Moreover, critical planning theory is associated with power, equity, knowledge construction, and related issues to test professional concepts against the real world [20–22]. Therefore, strategic planning must be systematic, it involves choosing specific priorities and making decisions about short-term and long-term goals [23,24]. Hoch argued that the theory was only deemed helpful for a limited number of specialized scenarios, not on a day-to-day basis [25]. In this sense, applying planning theory for specific funding allocation in higher education needs more empirical

investigations of actual planning in many different settings. As a national strategy plan, HESP should confirm its policy effect.

2.2. Meanings of Public Goods in Higher Education

The notion of public goods comes from economics and is rooted in neoclassical economic theories. Public goods are often assumed that it is non-competitive and non-excludable [26]. Previous studies argued it is impossible to exclude any individual from consuming the good [26,27]. The concept of public goods is never static as it continually is restated by various discourse communities [28,29]. For example, Daviet, claimed "a common good is a collective decision that involves the state, the market, and civil society" [30] (p. 8); Nixon identified the public good as "a good that, being more than the aggregate of individual interests, denotes a common commitment to social justice and equality" [31] (p. 1). Previous studies have shown that the economic conception of public goods has extended to social and other contexts. Daviet argued how well the economic conception of public goods provides a fundamental basis for understanding education's social, cultural, and ethical dimensions [30].

In educational contexts, Locatelli suggested that the framework of education as a public good and a common good may be seen as a sort of continuum in line with the aim of developing democratic political institutes that enable citizens to have a more extraordinary voice in the decision process [32]. Eryaman and Schneider indicated "a public good commitment necessitates a mutual understanding concerning the common goal of public education, an obligation to social justice and equality, and a focus on that provides learners with the skills needed for a meaningful role as a citizen" [11] (p. 8). UNESCO argued that education might confront the weakening of public goods under the alliance of scientism and neo-liberalism in the report "Rethinking Education" [5] (p. 78). Regarding higher education systems, public goods imply various meanings in different settings. As Marginson's discussion [33–35], we may assume that higher education is intrinsically neither a private nor a public, nor a common good. In addition, "it is potentially rivalrous or non-rivalrous and potentially excludable or non-excludable, which means that, being nested into wider social and cultural settings, higher education as a good is policy sensitive and consequently varies by time and place" [36] (p. 1051). Hence, it is reasonable to argue that it belongs to the category of quasi-public goods in China [37]. Previous studies have focused on conceptual discussions in public good contexts, such as Hazelkorn and Gibson's public goods and public policy [6]; Szadkowsk's conceptual approach [38]. Theoretical discussions provide broader thinking to explore this topic. In the substantive dimension, this study assumes that public goods initiatives in higher education settings can provide learners with the skills for playing a citizen role in the well-being of society, for example, quality education for the young generation, innovative research, and novel technologies for a better life.

2.3. Transferring Public Goods into Neoliberal Higher Education

Previous studies indicated that the present work on neoliberal higher education originated from a critical political economy approach [39,40]. Various researchers pointed out that academic communities are experiencing the phenomena, often referred to as 'academic capitalism' [41–43]; instead as the 'enterprise university' [44]; or modeled by a new set of parameters, for example, academic performance, accountability, rankings, competitive funding schemes, and so on. The ongoing neoliberal transformation of higher education has influenced the university and everyday academic life [10]. These phenomena in higher education are deeply embedded in a market-driven managerial logic. In contrast, some researchers have emphasized the public contractual funding of universities as the main lever of market-oriented reforms [45–47].

The market-oriented restructuring emerged in public research universities in Australia, Canada, the United Kingdom, and the United States following the decline of block grants and funding. The perspective has emerged that the government needs to decide what outcome of public goods is appropriate for society. Contemporary higher education seeks more conformable models under neoliberal times. The idea that universities have a mission to serve society has long been integral to the public imagination regarding higher education [48]. Public engagement policies in the UK are

older than that of most governments. Governments' initiated policies have emerged, for example, shaping the higher education landscape in terms of outcomes, management, and governance of institutes in Ireland; formulating a National Research Agenda involving a coalition of regular universities, universities of applied sciences, university medical centers, national research organizations, and industries in the Netherlands. Moreover, the EU agenda for higher education and the new global Education 2030 are committed to promoting equitable, affordable, and increased access to quality higher education [4,5].

In Asia, during the last 20 years, public or common goods have also triggered various discussions on higher education in China [37]. Huang and Horiuchi addressed the public goods of internationalizing higher education in Japan [49]; despite the acceptance of the concept of public goods, changes and reforms in the system have been dominated by demands from business and industry. In the international context, the related studies provide various examples of public goods initiatives in higher education.

2.4. Examples of Funding Allocations from Neoliberal Schemes to Public Goods

Two decades ago, the funding allocation in higher education was based on a competitive mechanism. The Ministry of Education in Taiwan has implemented two significant initiatives to enhance the quality of higher education, namely, the Aim for the Top University Plan [50,51] and the Program for Encouraging Teaching Excellence for universities and technological universities [14]. One focuses on lifting research performance; the other focuses on better teaching quality. The specific funds for selected higher education institutes are based on competitive schemes. Typically, these kinds of funding allocations are based on the neoliberal scheme.

In 2018, a total of 157 higher education institutes were funded by the HESP. The government allocated NT$ 17.37 billion for the first year of the HESP; a total of 65% (NT$ 11.37 billion) was allocated to the first part of the project, which focused on the quality of teaching and universities' social responsibility. In addition, 35% (NT$ 6 billion) was apportioned to the second part, which aimed to enhance the global competitiveness of universities in terms of pursuing quality research [15].

Analyzing the public goods transformation, we found the first part of the HESP is composed of the following four components: (a) promoting teaching innovation and learning effectiveness; (b) enhancing the publicness of higher education, including financial openness and promoting social mobility; (c) upholding university's social responsibility; (d) developing unique characteristics of universities. The second part of HESP focuses on pursuing leading international status for selected universities and research centers. The selected universities for global Taiwan includes National Taiwan University (NTU), National Tsing Hua University (NTHU), National Chiao Tung University (NCTU), and National Chen Kung University (NCKU). It revealed that the funding mechanism has transformed into a non-competition orientation.

There is NT$5.3 billion for the second part of HESP, including NT$4.0 billion for leading universities and NT$1.3 billion for research centers [14,15]. In addition, the Ministry of Education provides NT$2.57 billion for higher education institutions to implement local concerning projects and support disadvantaged students. The total funding from the Ministry of Education is NT$16.67 billion. The Ministry of Science and Technology provides another NT$0.7 billion to enhance the HESP. The details of the funding scheme in HESP are displayed in Table 1.

Table 1. Funding allocation scheme in HESP (unit: NT$ billion).

HESP	Funding (MOE)	Categories	Funding (MOST)
First part	65% (11.37)	80% allocated based on the quality of the project	0
		20% based on the institution's scale	0
Second part (Global Taiwan)	35% (5.3)	4.0 for leading university	0.7
		1.3 for research centers	
Total	16.67		0.7

HESP intends to drive public good policy into the higher education system using specific funding reallocations. The policy intends to secure students' equal learning rights and promote diversity in higher education. This study focuses on exploring the effects of funding allocation in HESP.

3. Materials and Methods

To explore the effect of HESP, this study employs a mixed method to clarify the issue of funding allocation for public good transformation. The research framework, data collection, and statistical analysis are addressed as follows.

3.1. Research Framework

This study conducted an input, transformation, and outcome (ITO) model to explore the effect of funding transformation for lifting the quality of teaching, research, and public goods in higher education. The data were collected from the Ministry of Education in Taiwan and Scopus database based on the targeted higher education institutes. To conduct the statistical tests, we defined the related variables in the ITO model as follows:

3.1.1. Input Funding (I)

It refers to funding at HESP for teaching, research, and public goods purposes. The variables in the input funding include funding for HESP, funding per student, and funding for teaching.

"Funding_in_HESP" refers to the funds for 157 institutes in the target country. The total amount is NT$15.34 billion (excluding the specific funding for selected research centers and the funding supported by the Ministry of Science and Technology).

"Funding_per_student" refers to the number of funds for students, which is the fund in each institute divided by the number of undergraduate students.

"Funding_for_teaching" refers to the fund being for teaching purposes only. The calculation considered the number of funds for teaching divided by the number of undergraduate students in each institute.

3.1.2. Transform Process (T)

It refers to human resources and the mechanism of transformation. The related variables in the transformation process include full-time faculty, international faculty, graduate students, and undergraduate students.

"Full_time_faculty" refers to the full-time faculty that the institute hired.

"International_faculty" refers to the full-time international faculty that the institute hired.

"Graduate" refers to the number of graduate students enrolled in the institute.

"Undergraduate" refers to the number of undergraduate students enrolled in the institute.

3.1.3. Expected Outcomes (O)

This study defines the expected outcomes as academic performance, USR_ranking, and international students in each institute.

"Academic-performance" refers to the total number of journal articles for each institute in the Scopus database from 2011 to 2019. These articles have been assumed to relate to the research that will promote social well-being or solve global issues and implies how the institutes face global competition and global issues.

"USR_ranking" refers to the projects for implementing social responsibility to fulfill local needs. This variable has been transferred on a ranking basis to compare the institute's engagement. The ranking was counted by the number of USR projects and their funding.

"International_students" refers to the number of international students enrolled in the institutes representing the global competition.

We consider the "System", which refers to the two different tracks of institutes in terms of university and technological university systems in the target higher education; "Sector" refers to the public and private institutes. The research framework is presented in Figure 1. The research questions to answer are as follows:

a. What are the influential factors of funding allocation in the HESP?

b. Did the funding allocation in HESP eliminate the diversity between the system and sector for public goods purposes?

c. Did a significant effect of public goods transformation on the target higher education system?

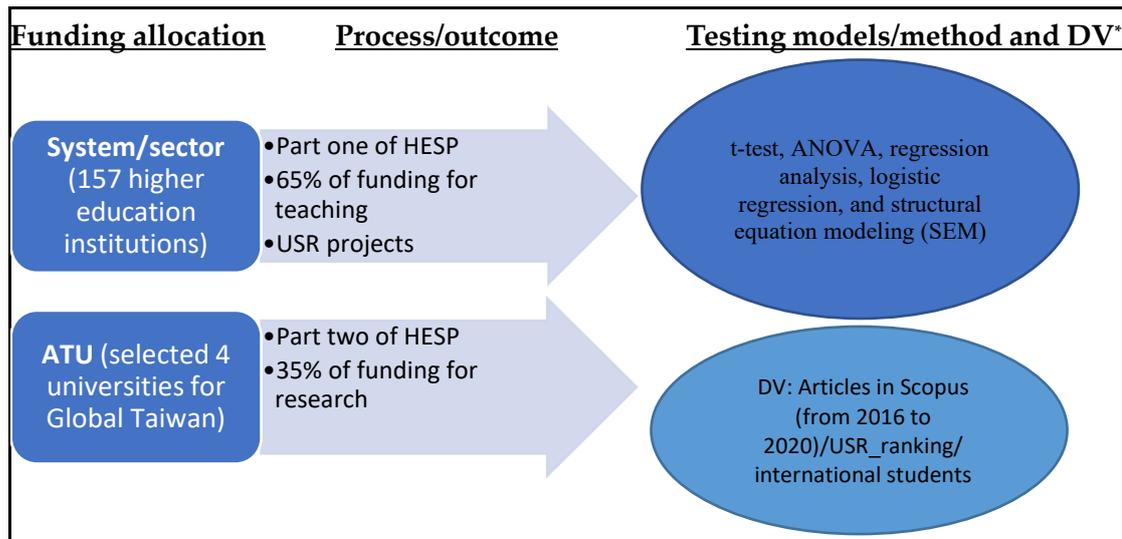d. Can we set better strategies by way of specific funding allocation towards public goods in higher education?

Figure 1. The research framework. *DV = dependent variables.

3.2. Data Collection

This study considered the students, faculty, and funding data in the 157 higher education institutes in Taiwan. The number of undergraduate and graduate students, international students, and faculty members was collected from the databank of the Ministry of Education, Taiwan. Among these institutes, 50 institutes (31.85%) belonged to the public sector, and 107 (68.15%) belonged to the private sector. The university system consists of 71 institutes (45.22%), while 86 institutes (54.78%) are classified under the technological system. The "full-time faculty" range is from 9 to 2,045, and the range of "Academic_performance" is from 44 to 127,006 articles from 2011-2019. The funding and USR data are based on a document published by the Ministry of Education. The institutional "academic_performance" data are based on Scopus databank. Most of the data belongs to secondary data. We integrated and transformed the data to fit the requirements of quantitative approaches.

3.3. Statistical Analysis

In this study, SPSS (the statistical package for social science), AMOS (Analysis of moment structure) and PLS-SEM (Partial least square SEM) were used to analyze statistic data. We employed t-test, analysis of variance (ANOVA), regression analyses, and structural equation modeling (SEM) to transform related evidence to support our arguments. First, ANOVA was used to determine the group differences with their means and variances. Considering the equal variances assumed or not assumed in the testing model, we conducted Levene's test to justify the equality of variance in SPSS. When Levene's statistic is not significant, it implies the variances in the groups are homogeneity. The Bonferroni test will be used to verify the group differences; otherwise, we will select the Dunnett T3 test [52]. Second, this study compared two different models to check the logic of funding with regression analyses. One includes all the possible variables to interpret the funding in the model. The

other excludes the selected top four universities to determine which variables critically influence funding without considering academic excellence purposes. The dependent variables are "Funding_in_HESP" (unit: NT$10000) and "Funding_per_student." The related independent variables will be selected by the stepwise method to build fitted regression models in these models. Third, logistic regression was used to determine the effects of funding allocation in HESP for the sector and different higher education tracks. Sector and track of universities are coded categorical variables and as dependent variables in the logistic models. Logistic regression estimates the probability of an event occurring, such as voted or did not vote, based on a given dataset of independent variables. Since the outcome is a probability, the dependent variable is bound between 0 and 1. In logistic regression, a logit transformation is applied to the odds—that is, the probability of success divided by the probability of failure. The odds ratio (OR) was calculated to reflect the effect of funding allocation in HESP with the sector and system in the current higher education institutes. The OR was calculated according to the following formula with conditions A and B [53]:

$$OR = \text{Odds of an event A / Odds of an event B}$$

We also considered the stepwise method with more complicated models in logistical regression. The significant tests set the critical value: as $\alpha = .05$.

Finally, SEM was used to verify the effect of funding allocation in the HESP. Typically, SEM was employed to model the relationship between measured and latent variables or between multiple latent variables. Since multiple regression is restricted to examining a single relationship at a time, SEM can estimate a series of interrelated dependent relationships simultaneously. This technique enables researchers to quickly set up and reliably test hypothetical relationships among theoretical constructs and those between the constructs and their observed indicators. Moreover, SEM is more effective than multiple regressions in parsimonious model testing. It is employed to find the best-fitting model [54].

We select funding for institutes and funding per student, and funding for teaching as formats of funding allocation in HESP; Full-time faculty, International faculty, undergraduate students, and graduate students are human resources variables that represent the transformation process. Academic performance, USR, and international students as expected outcome variables. IBM AMOS was used to verify the proposed model. We assume the following null hypotheses for testing:

Null hypothesis 1: There is no effect of input funding on expected outcomes;

Null hypothesis 2: There is no effect of input funding on the transformation process;

Null hypothesis 3: There is no effect of transformation process on expected outcomes;

Null hypothesis 4: The input funding will not, through the transformation process, impact expected outcomes.

This study considered the overall model fit in SEM using the following goodness-of-fit indices, including Chi-square minimum (CMIN), the ratio of Chi-square to degrees of freedom ($\chi2/df < 5.0$), goodness-of-fit index (GFI > 0.90), adjusted goodness-of-fit index (AGFI > 0.90), parsimonious goodness-of-fit index (PGFI > 0.50), root-mean-square residual (RMR < 0.08), and Akaike Information Criterion (AIC = $\chi2 - 2 \times df$) [55–58]. Following Shrout & Bolger's suggestion [59], the bootstrap method was used to estimate the mediation effect in this study. We selected resampling 2000 for bootstrapping. When Z > 1.96 (Z = point estimate/standardized error), implying that there is a mediation effect among the latent variables [60,61]. Considering the differences might exist in public and private sectors, we verify the effect with PLS-SEM. In PLS-SEM model, we will check Cronbach alpha, average extracted variance (AVE), composite reliability (CR), critical path and its coefficient [62–64].

4. Results

4.1. Influential Factors in HESP Allocation

This study considered a regression model with 157 institutes to interpret the logic of funding allocation in the HESP, by checking the total funding scheme and funding by each undergraduate student among these institutes. The proposed impact factors include undergraduate students, full-time faculty, international students, international faculty, and total articles on Scopus. The details of regression models are listed in Table 2.

Table 2. Testing the influential factors on funding allocation in HESP with regression models.

Models		Unstandardized		Standardized	t	p	Multi-Collinearity	
		B	Std. Error	*Beta*			Tolerance	VIF
Dependent Variable = Funding_in_HESP (unit: NT$10000)								
1	(Constant)	1573.849	691.404		2.276	.025		
	Academic_performance	1.422	.041	.955	35.010	.000	1.000	1.000
Dependent variable = Funding_per_student								
1	(Constant)	6673.080	907.437		7.354	.000		
	Academic_performance	.621	.053	.732	11.658	.000	1.000	1.000
2	(Constant)	12729.642	1662.930		7.655	.000		
	Academic_performance	.973	.097	1.145	10.051	.000	.265	3.770
	Full_time_faculty	-24.879	5.875	-.483	-4.235	.000	.265	3.770

Note. Academic_performance represents articles collected in Scopus database.

The regression model reveals that the funding of the HESP for each institute is based on the number of articles in Scopus due to the high relationships between "Funding_in_HESP" and "Academic_performnace". The R is 0.955 in terms of the articles in Scopus, which can explain 91.2% of the funding among these institutes. The finding reveals research focus may be overweight in HESP. Second, in considering the funding by each undergraduate student (Funding_per_student), this study found "Academic_performance" and "Full_time_faculty" were influential factors in interpreting the Funding_per_student in each institute (R = 0.773, R^2 = 0.597). If the number of undergraduate students can reflect on the scale of institutes, the result reveals that the funding allocation in HESP needs to consider the scale of institutes properly. In our proposed regression models, the t values and their p reveal that the models are significant. Since the VIF is slim, there are no multi-collinearity problems when the variables fit in the models.

4.2. The Logic of Funding Allocation in HESP

The result reveals the average funding for each higher education institute is NT$9770.52 (unit: NT$10000). Regarding the sector, this study found the average funding for public universities shared NT$20297.72, while funding for the private universities & colleges only shared NT$4851.27 ($t$ = 4.686, p = 0.000). Regarding the system, the average funding for universities shows the sharing of a more considerable amount than that of technological universities & colleges (NT$15055.94 vs. NT$5406.98) (t = 3.011, p = 0.003). Table 3 shows that Funding_in_HESP, Funding_per_student, and Funding_for_teaching significantly differ between sector and system in the HESP. The finding reveals the only diversity shown in private technology groups that received less funding from HESP. Since the oversupply issue in higher education has confronted the higher education system, private technology institutes will threaten the declining birthrate in Taiwan. While the findings reveal that the policy intention for funding allocation in HESP and its practice existed a little gap, it is still acceptable considering the equality for most institutes.

Table 3. Different types of funding allocations for institutes by sector and system.

Types of Funding Allocation	Sector	System	Average	*SD*	Institutes
Funding_in_HESP (unit:NT$10000)	Public	University	24424.67	40236.961	33
		Technological Univ.	12286.59	9792.666	17
		Total	20297.72	33501.701	50
	Private	University	6919.95	5676.948	38
		Technological Univ.	3712.00	3731.468	69
		Total	4851.27	4749.801	107
Funding_per_student (Amount of fund based on undergraduate students)	Public	University	18481.24	19053.07	33
		Technological Univ.	14973.47	7451.55	17
		Total	17288.60	16063.07	50
	Private	University	11220.92	12972.95	38
		Technological Univ.	4700.65	3090.10	69
		Total	7016.26	8642.86	107
Funding_for_teaching (Teaching purposes only based on undergraduate students)	Public	University	9240.73	9526.55	33
		Technological Univ.	7486.76	3725.76	17
		Total	8644.38	8031.55	50
	Private	University	5610.42	6486.52	38
		Technological Univ.	2350.36	1545.50	69
		Total	3508.14	4321.44	107

4.3. Transformation Diversity between System and Sector

For balancing the system, the result of logistic regression reveals that both university and technological university systems can be explained by "Funding_in_HESP", "Undergraduate", "Full_time_faulty", and "International_students" (R^2 = 0.45, AIC = 124.91). It implies that the four selected variables can explain the effect of the system with 45% of variances in the model. The results processed by the stepwise method in the logistical regression model are shown as follows:

$$Y' = -0.815 - 0.000176 \times Funding\_in\_HESP - 0.000964 \times Undergraduate + 0.02225 \times Full\_time\_faculty + 0.00792 \times International\_students$$

Y' refers to the system, 1 is the university system, 2 is the technology system. The findings suggest that the university system is favored by HESP. While the significant odds ratio over 4 implies a strong influence, in this case, the odds ratios are slim (Table 4).

An analysis of the effects of the sector shows that both the public and private sectors can be explained by the amount of funding and undergraduate students in the logistical regression model (R^2 = 0.3139, AIC = 152.34). It is:

$$Y' = 0.000195 \times Funding\_in\_HESP - 0.000329 \times Undergraduate;$$

The result reveals that the model only explained 31.39% of variances with funding and undergraduate students. The ratio of "Funding_in_HESP" for the public sector is 1.0002 for the private sector, and the odds ratio of "undergraduate" for the public sector is 0.9997 for the private sector. The findings reveal that the public and private sector gap is minimal.

Table 4. Odds ratios for systems with selected predictors.

Selected Predictors	Odds Ratio	95% CI
Funding_in_HESP (NT$10000)	0.9998	(0.9997, 0.9999)
Undergraduate	0.9990	(0.9986, 0.9994)
Full_time_faulty	1.0225	(1.0102, 1.0350)
International_students	1.0079	(1.0042, 1.0117)

4.3. Expected Outcome in Global Taiwan

The academic performance of Global Taiwan universities has shown declining from 2016 (10,322 journal articles) to 2018 (9,678 journal articles). In contrast, the HESP started in 2018, encouraging selected universities and steadily increasing their academic publications (see Table 5).

Table 5. Transformation of research performance in global Taiwan universities.

Universities	2016	2017	2018	2019	2020
NTU	4,713	4,640	4,580	4,888	5,398
NTHU	1,581	1,518	1,467	1,579	1,688
NCTU	1,569	1,481	1,396	1,570	1,782
NCKU	2,459	2,321	2,235	2,252	2,634
Total	10,322	9,960	9,678	10,289	11,502

4.4. Expected USR Implementation

There are 220 USR projects conducted in 116 institutes. It implies 549 proposals submitted for financial support, while only 40% of them were accepted in HESP. USR refers to university social responsibility, it is also reflected that the institute engaged in social development to fulfill local needs. The result reveals that the university system conducted 102 projects, while the other 118 were implemented in the technological university system. It also shows that 46.36% of the USR projects belong to the public sector, and the other 53.64% belong to the private sector. The change has shown more significant differences than it did before.

4.5. The Relationship of Academic Performance and USR

Figure 2 displays that academic performance (for global competition) and USR (local needs) implementation has a significant positive relationship among higher education institutes. We divided the number of articles into four groups (Q1 to Q4) in terms of Q4 being the best group, Q1 being the last group compared to their articles in Scopus. USR(Rank) refers to the funding received by ranking the institutes from 1-9 in HESP. It means that the more the special funding received, the stronger the relationship that the institutes will fulfill local development needs and global competition in the HESP framework. The result reveals that both expected outcomes positively correlate with balancing global competition and local needs ($R^2 = 0.130$, $p < 0.05$).
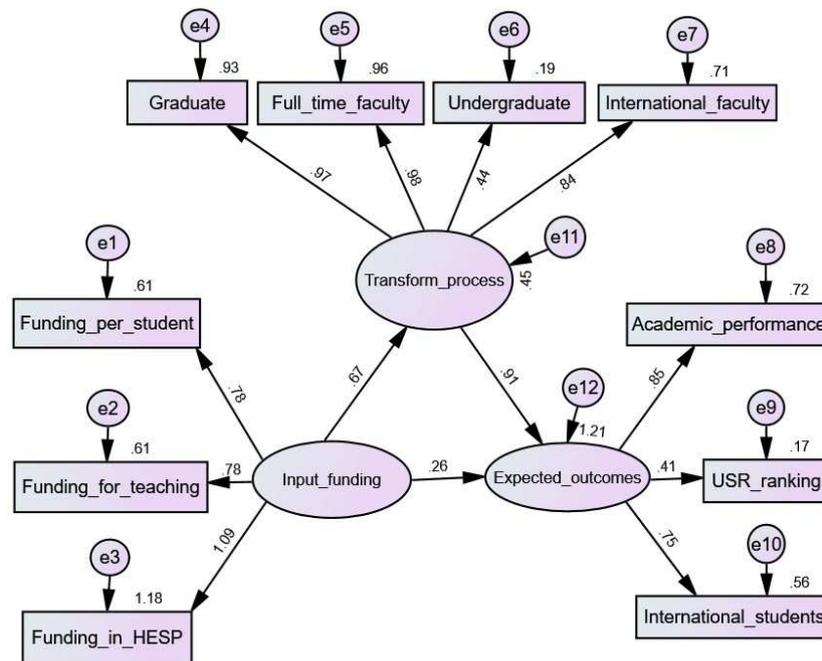
Figure 2. The relationship between academic performance and USR.

4.6. Testing ITO Model with SEM

This study employed the scale-free least squares (SLS) method to test the proposed model, it indicated that the CMIN was 144.943 and the degree of freedom was 29. The result reveals that the value of χ^2/df was 4.998, which implied an excellent fit (4.998 < 5.00). The related model-fit indices, for example, GFI, AGFI, and PGFI are, exceeded the acceptance levels (that is GFI = 0.956 > 0.90, AGFI = 0.920 > 0.90, and PGFI = 0.522 > 0.50 in the fitted SEM model). The RMR (root-mean-square residual) > 0.08, while AIC is 86.943 (AIC = $\chi^2 - 2 \times$ df), it tended to be small. The estimated standardized coefficients are 0.256, 0.671, 0.910, and 0.614 in H1 to H4, respectively (see Table 6). The results of the null hypotheses test are listed as follows:

Null hypothesis 1: There is no effect of input funding on expected outcomes (Rejected);

Null hypothesis 2: There is no effect of input funding on the transformation process (Rejected);

Null hypothesis 3: There is no effect of transformation process on expected outcomes (Rejected);

Null hypothesis 4: The input funding will not, through the transformation process, impact expected outcomes (Rejected).

Table 6. Estimated standardized coefficients and *p*-values.

Hypotheses	Coeff.	*p*
H1: Input funding → Expected outcomes	0.256	*
H2: Input funding → Transform process	0.671	*
H3: Transform process → Expected outcomes	0.910	*
H4: Input funding → Transform process → Expected outcomes	0.614	*

*$p < 0.05$.

Since the null hypotheses are rejected, the results suggest that the input funding in HESP and the transformation process have significantly impacted the expected outcomes. Figure 3 displays the estimated structural relationship. It implies that the effects of transformation are significant.

Figure 3. ITO model in SEM.

4.7. Testing Mediation Effect

Based on Table 6, the estimated coefficients and *p*-values have shown they are significant in the SEM model (that is, if *p* is less than 0.05, the estimated coefficients are valid). We found that the coefficient β_1 (Input funding → Expected outcomes) is also significant ($\beta_1 = 0.256$, $p = 0.002$). β_2 (Input funding → Transform process) is significant ($\beta_2 = 0.671$, $p = 0.001$), and β_3 (Transform process → Expected outcomes) is significant ($\beta_3 = 0.910$, $p = 0.000$). Since the model demonstrates $\beta_2 * \beta_3 > \beta_1$, the transform variables might exert a strong mediation effect in this model. We used a bootstrap method to estimate the model's mediation effect with 2,000 samples in AMOS. The result showed that the effect of mediation (Input funding → Transform process → Expected outcomes) was 0.614, and it was significant at the 0.05 level ($p = 0.000$). The details of the indirect effect (mediation effect), direct effect and total effect, *p*-values, and 95% confidence interval of bias-correction accelerated percentile (BCa) are listed in Table 7. Based on the *p*-values, the estimated coefficients for indirect, direct, and total effects are significant in bootstrapping process with BCa.

Table 7. Estimated indirect, direct, and total effect with BCa.

Effects	Estimated coefficients	*p*-values	BCa 95% CI
Indirect effect			
Input funding → Transform process → Expected outcomes	0.614*	0.000	0.435 ~ 0.756
Direct effect			
Input funding → Expected outcomes	0.256*	0.002	0.139 ~ 0.408
Input funding → Transform process	0.671*	0.001	0.446 ~ 0.804
Transform process → Expected outcomes	0.910*	0.000	0.815 ~ 0.999
Total effect	0.866*	0.001	0.741 ~ 0.933

*$p < 0.05$.

4.8. Verifying the Effect of Private Sector by PLS-SEM

Considering the effect of funding allocation in private sector, we employed PLS-SEM to verify the transformation process. The result of PLS-SEM indicated that Cronbach alpha in input funding, transformation process and expected outcome are 0.811, 0.931, and 0.651, respectively. The model demonstrates the AVE are 0.522, 0.827, and 0.588 in input funding, transformation process and expected outcome, respectively. The composite reliabilities are 0.771, 0.950 and 0.808 in the model. The findings suggest that the testing model for private sector transformation public goods are fitted. Figure 4 shows the weighted regression coefficients and path diagrams in the model. The transformation process in private sector works well.
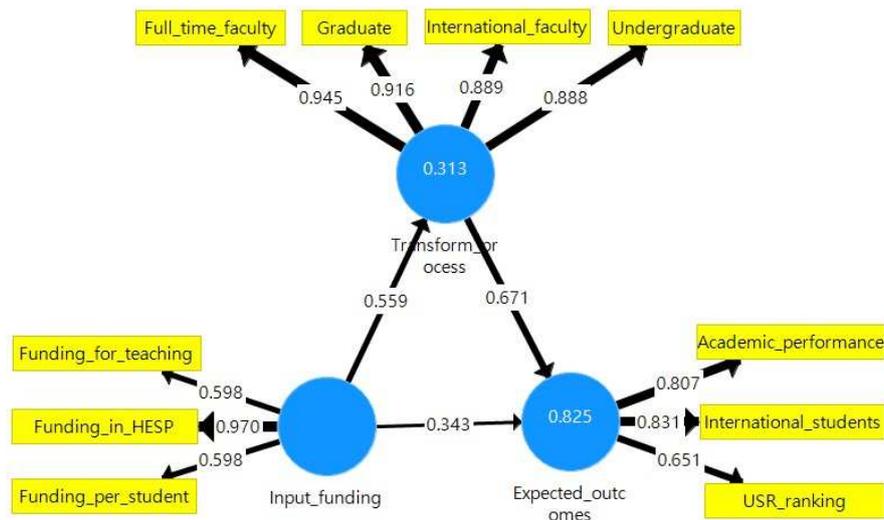
Figure 4. The transformation effect in private sector with PLS-SEM.

5. Discussion

Previously enhanced quality and introduced teaching excellence programs in Taiwan are based on the competitive mechanism [51]. The adverse effects have been reported, for example, over-emphasized the evaluation and the requirement of accountability in a short period [65]. Studies from the perspectives of students and teachers indicated that universities receiving Teaching Excellence Program grants failed to meet their expectations [66,67]. It is why the HESP was initiated. Can public goods work well in higher education with a series of policy-driven reforms in neoliberal contexts? In the beginning, the HESP considered targeting the quality of higher education institutes and balancing institutional excellence and caring the quality teaching for disadvantaged students. A specific fund from HESP is offered for all higher education institutions instead of a competition scheme. In addition, this study found that the expected outcomes are academic performance and international student recruitment, whereas the impact of USR is still limited. In SEM testing, the findings suggest that the initial funding provided by HESP can impact the expected outcomes through the transformation process. The mediation effect of the transform process is significant in the proposed model. Compared with previous policy initiatives, the most significant change in the HESP is implementing USR. The USR consists of strengthening university-industry collaboration, fostering cooperation among universities and high schools, and nurturing talents required by local economies. In the long run, the influence of USR projects will increase in higher education. In this sense, HESP provides an example to demonstrate that USR could be a crucial factor in the model.

In this study, we also raised two crucial questions: How wide is the gap in the funding allocation in HESP between the system and sector for public goods? What are the influential factors for funding allocation in the HESP? HESP encouraged higher education institutes to promote teaching innovation by enhancing learning effectiveness and teaching quality to reduce inequality. Based on the effect of funding allocation, this study found that some issues are emerging in the HESP. First, the HESP aims to secure students' equal rights to access quality and diverse higher education systems. Suppose the

equal rights to access higher education should reflect no significant difference in their funding allocation for institutes. While the funding scheme reveals that the institutional scale needed to reflect the funding allocation properly, the gap between universities and private technological universities or colleges has existed. This example may provide an alert to related policy good initiative in higher education. Funding for public good implementation should consider sector balancing in higher education. Fortunately, the result of SEM confirm the transformation process works well in both sectors.

Second, this study found that the funding of the HESP for each institute is based on the number of articles in Scopus due to their high relationship in the testing model. The government encourages higher education institutes to propose their institutional projects with unique characteristics. At the same time, the result reveals there is a similar culture on campuses where encouraging article production is persisted. At this point, how to balance teaching and research needed to be considered in next stage of HESP.

In a global context, higher education policies typically have been shown to provide incentives for universities to develop or strengthen their capacity of the academic profession and performance in neoliberal times [2,7,68,69]. Various funding studies have focused on global competition discussions in neoliberal contexts [10,39,41]. In comparison, we have perceived that various studies indicate that the concept of public goods might play a significant role in higher education [11,34,36]. Like the EU agenda for higher education and the new global Education 2030 [4,5], Ireland's National Strategy for Higher Education to 2030 and the Dutch National Research Agenda also provide ambitious purposes for public goods in higher education. It may indicate a possible transition within the neoliberal regime from competition-oriented to public goods-oriented systems.

Can significant policy initiatives transform public goods in neoliberal higher education settings? This study provides an empirical example (an ITO model) to evaluate the core values of public goods and their practices in higher education settings. The findings suggest that when higher education is considered from a public goods perspective, the competitive funding scheme should consider the policy's intention and the effect of implementation. Even though the policy intention is evident in this case study, the change still needs to be faster and more predictable in neoliberal higher education contexts. This study agreed that a common good is a collective decision that involves the state, the market, and civil society [30]. Since it is impossible to exclude any individual from consuming the good [26,27], higher education policy for public good intervention may need adequate resources for long-term support. The study found that current policy intention and short-term funding support could have fit better. It may reflect that the effects are not satisfied for higher education institutes at this stage.

What does this imply for contemporary higher education? As higher education moved into a globally competitive era, the question arose about putting public goods schemes to work in a neoliberal context. Tian and Liu's study indicated that public or common goods also triggered discussions on higher education in China [37]. Huang and Horiuchi addressed the public goods of internationalizing higher education in Japan [49]. Despite the acceptance of the concept of public goods, changes and reforms in the Japanese system has been dominated by demands from business and industry. In general, performance funding is based on an input-output model of services where services are to be financed by government agencies in terms of output indicators. Many European countries have implemented some form of performance-based funding in higher education. For example, implementing Research Performance Based Funding (RPBF) systems aims to improve research cultures and facilitate institutional changes that can help increase research performance [70]. Many EU countries have introduced, are introducing, or are considering introducing such systems. Some positives have been received. Whereas, considering the implementation of public goods, tuition, and fees have traditionally been low in Europe, reflecting the view that higher education is a public good [71]. There are alternative funding schemes to fit various performance purposes in European countries.

Zerquera and Ziskin's study indicated that performance-based funding requirements interact with the public-serving mission of urban-serving research universities (USRUs) in the USA and can

deepen stratification across a differentiated system [72]. Policymakers, institutions, and researchers must work towards synergistic interactions to deepen understanding and vision for a better society. In the initial transformation stage, it is an essential factor that leads the program to success in higher education. Moreover, various studies have focused on how performance-based funding impacts marginalized students [73–76], with findings across these studies essentially pointing to adverse effects on access for underrepresented students. This study did not find significant evidence to support that HESP positively affects underrepresented students.

Taking HESP as an example, ITO model may provide a holistic perspective to reflect the issues in neoliberal higher education regardless of the public and private sectors. With higher education institutes, the effectiveness of education, research, and innovation can correctly connect to societies. As stated in previous discussions, the private sector does not usually provide pure public goods; therefore, pure public goods in higher education are a minimal phenomenon [48]. In this study, we demonstrate that the effect of specific funding for public goods are significant regardless the sectors in higher education. The example of HESP may provide a more profound understanding of funding allocation for public goods in neoliberal times. Even though the private sector received limited public funds in HESP, the funding-driven policy encouraged all private institutes in this case study.

6. Conclusions

This study took the HESP in Taiwan as an example to test the effect of transforming public goods in neoliberal higher education. The findings suggest that the government initiated the HESP and targeted the quality of higher education institutes in which institutional excellence and caring for disadvantaged students' learning could balance. Regarding this core issue, the policy managers need continuous discussions between partners to overcome the funding gaps for public goods purposes. The study reveals that public goods can transform into higher education by reshaping what universities expect to do in an uncertain future. This case study may provide a valuable reference when policy design considers theories and practice issues for transforming public goods.

Moreover, this study focuses on the following concerns for higher education: First, reshaping institutional strategies for public goods and promoting strong institutional characteristics for substantive development in the future is necessary. Second, it is crucial to continue balancing academic excellence and quality teaching; commitment to implementing innovative and quality teaching for disadvantaged groups should be the premier institutional strategy for most institutes. Third, higher education institutes should commit to achieving remarkable progress in expanding learning opportunities for all as the initiatives of the UN's SDGs. With fitting funding, higher education can find ways to respond to the challenges of local and global issues. Finally, we know that sustainable higher education is a long-term goal and needs many resources and partners to support it. We hope this case study can provide a helpful example to explore similar issues in higher education settings further.

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