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The multi-layered and multilevel use of bibliometric measures in Swedish universities: Isomorphism, translation and strategic choice[1]

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Introduction

In recent years, systems for resource allocation in academic research based on performance indicators have been introduced in many European countries (Hicks, 2012), leading to an emerging discussion on the rationale, design and possible consequences of these systems (Weingart, 2005). Today, we are at a point where the use of bibliometrics based indicators for research evaluation and resource allocation more or less permeates academic systems on all levels and across the world: at the macro-level, we find national systems for allocating resources between higher education institutions (HEIs); and at the micro-level, the use of bibliometric indicators for distributing funds to individual scholars is also on the rise (Wildgaard et.al, 2014; Woelert & Yates, 2014). The research evaluation landscape has resulted in complex assemblages of indicators, where scholars and publications are measured on all levels through the use of a wide range of indicators and models (Burrows, 2012). The implementation—and the effects of the use—of bibliometric indicators on the micro- and macro-levels have been studied, but the exploration of the use of bibliometric indicators for resource allocation in academic research on the meso-level—that is within HEIs, between faculties and departments—has so far been limited, albeit with some exceptions (Aagaard 2015; Hammarfelt & de Rijcke 2015; Chatelain-Ponroy et. al, 2014).

The purpose of this study is to provide a comprehensive overview and analysis of the local use of bibliometric indicators at Swedish universities. Based on a brief background describing the role of bibliometric indicators in resource allocation systems, and in Swedish academia in particular; and a survey on the use of bibliometric indicators at 26 Swedish HEIs, we analyse our findings with a focus on indicators used and levels of application. The results of the analysis are interpreted from an institutional perspective in the context of organisational and structural change (DiMaggio & Powell, 1983; Karlsson et. al, 2012).

The context of resource allocation systems

Performance based resource funding systems (PRFS) based on bibliometric indicators has become a common feature in several European countries. In an overview by Hicks (2012), there were 14 countries—eleven of which being European—either having implemented, or being in the process of developing/implementing, PRFS. These systems are often introduced with the rationale of enhancing competitiveness in an increasingly global market of research and higher education, but the further focus on assessment can also be discussed in relation to

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new public management and a further focus on accreditation and evaluation across many sectors (Dahler-Larsen, 2012).

The current Swedish system for research evaluation was introduced in 2008 (Sandström & Sandström, 2009). It allocates resources across Swedish universities using two indicators: field normalized citation scores and external funding. Originally, 10% of the total state funding for Swedish HEIs was allocated based on these indicators; and since 2014, 20% of the state funding is performance based as reflected in citation scores and the amount of external funding. The model has been criticised for not being robust enough (Ahlgren, Colliander & Persson, 2012), and concerns has also been raised regarding its potential bias against the humanities. In 2014 the Swedish research council proposed an alternative evaluation system for a performance based resource allocation system based on peer review panels (Vetenskapsrådet, 2014).

The national system for research evaluation is likely to have influenced the development of local models, but the complexity of this system and its difficulties in capturing research output in the social sciences and humanities has led to the implementation of other systems at various HEIs, often inspired by the Norwegian model for research evaluation and resource allocation. Briefly, the Norwegian system builds on two essential components; (1) a comprehensive national database of publications, and (2) a two-level system for grading publications, taking into account the type of publication as well as the level of prestige of the journal or the publishing house (Schneider, 2009).

Methodology and theoretical perspective
In total, there are 47 institutions of higher education in Sweden, out of which the 27 HEIs awarding doctorate degrees were selected for our study. The remaining institutions are mainly focused on teaching and can thus be expected to have little use for bibliometrics for research evaluation. A survey of eight questions was sent to these 27 HEIs and we received answers from 26. We asked if the HEI use bibliometrics for resource allocation, and if so which indicators they use. We also enquired regarding on which level bibliometrics based allocation is performed.

Our theoretical focus is inspired by new institutionalism theories (DiMaggio & Powell, 1983) and we build on Karlsson and colleagues (2014) and their study of institutional response to further demands on evaluation of teaching. More specifically we utilize two concepts from their approach: isomorphism and strategic choice. The theory of isomorphism suggests that organisations have a tendency to imitate each other given that they operate under the same circumstances. However, it is rarely a question of straight implementation of values or practices, but rather an on-going translation where internal actors give local meanings to external ideas. Hence, organizations will respond differently to external demands as a result of local traditions and organizational structures, despite the outside demands remaining the same. Organizations with a self-image of having a high level of autonomy, such as universities, might also resist being depicted as an institution being influenced by external factors, and rather present a narrative where evaluation exercises are presented as a strategic choice rather than as a response to external pressure.

Findings
Bibliometric measurement is currently applied in 24 of the 26 HEIs in our study (Table 1). Hence, performance based allocation of research funds is now the norm rather than something exceptional. However, it should also be noted that many of the larger all faculty universities—

such as LU, GU and SU—do not use bibliometric indicators for resource allocation across the whole university. Instead there are individual faculties and departments within the university that has opted for using bibliometric indicators as a basis for distributing funds between smaller units of the organization.

Table 1. HEIs analysed, size according to number of employees, profile and use of bibliometric indicators

HEI	Nr of employees (2012[i])	Profile	Systematic use of bibliometric indicators
Lund University (LU)	6573	General	Yes
Uppsala University (UU)	5375	General	Yes
University of Gothenburg (GU)	4765	General	Yes
Stockholm University (SU)	4143	General	Yes
Karolinska Institutet (KI)	3875	Medicine	Yes
Umeå University (UmU)	3633	General	Yes
Royal Institute of Technology (KTH)	3470	Polytechnic	Yes
Linköping University (LiU)	3129	General	Yes
Swedish University of Agricultural Sciences (SLU)	2962	Agriculture	Yes
Chalmers University of Technology (CTH)	2618	Polytechnic	No
Linneaus University (LNU)	1659	General	Yes
*Malmö University (MAH)	1396	General	Yes
Luleå University (LTU)	1336	General	Yes
Karlstad University (KAU)	1040	General	Yes
Örebro University (ÖU)	1017	General	Yes
Mid Sweden University (MIU)	909	General	Yes
*Mälardalen University (MDH)	809	General	Yes
*Södertörn University (SH)	694	General	Yes
*Jönköping University (HJ)	665	General	Yes
*University of Borås (HB)	620	General	Yes
*University of Gävle (HiG)	558	General	Yes
* Halmstad University (HH)	493	General	Yes
*Blekinge Institute of Technology (BTH)	459	Polytechnic	Yes

*University of Skövde (HS)	404	General	Yes
Stockholm School of Economics (HHS)	218	Economics	No
*The Swedish School of Sport and Health Sciences (GIH)	122	Sport and health	Yes

*University Colleges entitled to award third-cycle qualifications in one or several disciplinary domains.

Heterogeneity in the use of bibliometric indicators
The Swedish academic landscape is heterogeneous, in terms of profiles and type of organization of the HEIs, as well as the size of them; and there is also a large variation in terms of what kind of bibliometric indicator—if any—being used for resource allocation. Generally, we can identify three main types of indicators: those counting number of publications, those based on citation frequency, and those making calculations based on a combination of citation and publication counts (Table 2).

Table. 2. Type of indicator and type of organization.

Type of organization	Type of indicator			
	Publication based	Citation based	Mixed	None
University	SU*, LNU		LU*, UU*, GU*, UmU, LiU, KAU, ÖU	
Specialized university/college	LTU, BTH	KI, KTH	SLU, GIH	CTH**, HHS**
University College	MIU, MDH, SH, HB, HiG, HH, HS		MAH, HJ**	

*Not used throughout HEI, only at certain faculties/departments.
**Privately owned institutions managed in collaboration with the Swedish government.

Publication based models are predominantly used by university colleges, but this type of model is also used at LNU and the faculty of Arts at SU, as well as at LTU and BTH. The types of publication counts used as indicators ranges from a straight count of peer reviewed publications (HB), to using variations of the Norwegian model (SH, LNU). At LNU, counting publication points according to the Norwegian model is only the first step, which is followed by normalizing these points using a benchmark from similar departments at other universities. In addition to this, LNU also awards points for articles in journals indexed in the Web of Science (WoS) databases; and whereas the original Norwegian model do not reward papers in conference proceedings, LNU award papers in conference proceedings the same point as book chapters.

The only HEIs using citation based indicators across the university are the two largest specialized organizations, KI and KTH. While KTH use field normalized citation counts, KI—in addition to field normalized citation counts—also takes journal impact factor and the total number of citations into account. Using a citation-based indicator across the organization is of course related to the disciplinary profile. Being either medical (KI), or polytechnic (KTH), universities, the publication patterns at both institutions are generally of the kind that

will be well covered in for instance the WoS databases. However, whereas the use of publication based indicators is possible utilizing local publication archives in combination with openly available rankings such as the list of journals and publishing houses used in the Norwegian model, using citation based indicators makes access to expensive databases necessary. In addition to this, using complex indicators such as field normalized citation counts also necessitates the access to well-trained expertise, which is reflected in both KI and KTH being the Swedish HEIs with perhaps the most well-developed—as well as well staffed—centres for in-house bibliometric expertise.

HEIs using mixed models are primarily larger, all faculty universities (e.g. UU, GU, UmU, LU), where different indicators are used for different research areas. One such example is at LU, where the Faculty of Social Sciences use one variation of the Norwegian model—doing whole counts of peer reviewed publications taking publication type into account—while the School of Economics another variation of the Norwegian model—making fractionalized counts of publications taking both publication type and prestige of the journal/publishing house into consideration. And at the Faculty of Science, field normalized citation counts are used when distributing funds across the faculty. At LU, there is, however, no distribution of funds based on bibliometric indicators centrally. At UmU on the other hand, different faculties has their own different models for allocating resources between departments, but there is also a centrally used model for distributing funds between faculties, which is basically a mechanistic model based on the national citation based system. Thus, if we look at LU and UmU on the central, university level, UmU could be categorized as HEI using a citation-based model while LU would be one not using bibliometrics based indicators at all. One important aspect to consider it the case of the larger—and perhaps in particular also the older—all faculty universities is the relative independence of the faculties, reflected in not only the choice of models for distributing funds, but also in choice of evaluation methods for other purposes. In some cases, it might be more or less politically impossible for the central university management to impose evaluation methods on the faculties.

There are two HEIs that do not apply bibliometric indicators for allocating resources on any level. Both these are specialized HEIs: HHS is a business and economics university and CTH is a polytechnic university—although it should be mentioned that CTH is currently discussing the implementation of a bibliometrics based system. Apart from being specialized HEIs, it should also be noted that both CTH and HHS are privately owned institutions, whereas all but one other HEI in Sweden (HJ) are formally government institutions.

Multilevel assemblages of bibliometric measurements
As previously mentioned, not all HEIs use bibliometric indicators for resource allocation on all levels, or even the same indicator on different levels within the organization, as we can see in the section on the use of mixed indicators. As with the choice of publication or citation based indicators, we find a wide variation in terms of on which levels bibliometric indicators are used for distributing resources at different HEIs, from distribution of resources between faculties at the university to the allocation of funds to individual scholars (Table 3). And while we find indicators used for distributing funds being used on all various levels, there is only one HEI (UmU) who is using indicators on all organizational levels.

Table 3. Levels on which bibliometric indicators are being used.

	University*	Faculty**	Individual
HEI	Universities and specialized universities/colleges		
LU		X	

	*	**	
UU	X	X	
GU		X	
SU		X	
KI		X	
UmU	X	X	X
KTH	X		
LiU		X	
SLU	X	X	
LNU	X		X
LTU		X	X
KAU		X	X
ÖU	X		
BTH			X
GIH			X
University colleges			
MAH	X	X	
MIU		X	
MDH	X		
SH		X	X
HJ	X	X	
HB	X		
HiG		X	
HH		X	
HS		X	

* Distribution between faculties or similar administrative level within the university.
** Distribution between departments or similar administrative levels with the faculty.

Excluding the two HEIs not using bibliometric indicators at all (CTH and HHS), ten out of 24 HEIs uses bibliometric on the university level, that is for distributing resources between faculties or organizations on corresponding organizational level. The most common level where indicators are used for distributing funds is on the faculty level—that is between departments within the faculty. There are no substantial differences between universities/specialized universities and university colleges in terms of distribution of funds on the university and faculty levels. However, when it comes to resource allocation on the individual level, there is only one university college (SH) using indicators for this purpose while there are six universities/specialized universities practicing this.

The use of bibliometric indicators for the evaluation of individuals is usually discouraged by bibliometric expertise. Yet, there are plenty of indicators developed for individual level evaluation on the (Wildgaard, Schneider & Larsen, 2014); and seven out of the 26 HEIs in our sample are using bibliometric indicators to allocate resources to individuals. The models used at BTH and LTU are perhaps the most straightforward ones as they directly allocate resources—in the form of research time or travel money—based on articles published in journals indexed in Web of Science or rated at prestige level two in the Norwegian system. For an article published in a journal rated at level two in the Norwegian system a scholar at LTU receives 35,000 SEK (about 3,800 EURO); and an additional 35,000 SEK is awarded if the journal is indexed in WoS. An analogous system is used at BTH where a WoS indexed article is 'worth' 30,000 SEK. A more complicated system is used at LNU where publication points are translated into resources.

Discussion

Performance based allocation based on bibliometric indicators has become the norm in Swedish academia. The overall discussion is focused on what type of bibliometric indicator to use, rather than if bibliometrics should be used at all. However, one interesting point is that two HEIs has yet to develop a resource allocation system based on bibliometric indicators, and both these HEIs are independent foundation universities, that is, institutions that are not directly subordinated to the Swedish government and the Department of Education. In Sweden, there is only one more foundation university, so two out of three private HEIs have not implemented bibliometrics based resource allocation systems. The degree of independence and how it influences the use of bibliometric measurement is indeed an intriguing factor which warrants further attention, and perhaps could international comparisons shed further light on this issue.

From a viewpoint of 'new institutionalism' we could describe the current focus on bibliometric measurement at Swedish HEIs as a result of isomorphism. The extensive implementation of allocation models based on bibliometric measurements would in this interpretation be described as result of imitation, or as a consequence of operating under the same constraints (the national model of resource allocation). Still, even if many allocation models resemble each other we find that a range of different indicators is used on various levels. There is indeed a lot of overlap between models but all are unique and a large variety of indicators are used. The main explanation for this is the large diversity of HEIs. Generally, we find that large older universities, where faculties have a strong independence, often opt for diversified systems using both publications and citations—if there are any central university management decisions at all, in some cases the faculties make their own decisions on what indicator or system, if any, to use whereas there is no central model for the whole university—while smaller universities and university colleges usually choose publication based models. Among the larger of the more specialized HEIs, there is a tendency for the HEIs to develop more specialized and complex systems—to a larger extent using citation based indicators—that demand resources both in form of infrastructure (access to databases and analytical instruments/software) and personnel with specific competencies. Hence, incentives on the national level may be adjusted to fit in a local context. Similarly, a study of bibliometric indicators in Norway also found that national models 'trickled' down, but the high degree of autonomy of universities, faculties and departments lead to large variety in how national indicators are implemented locally (Aagaard, 2015).

A telling example is UU where the national model was said to be the motivation for implementing performance based resource allocation (Hammarfelt & de Rijcke, 2015). However, as citations could not be applied across all fields it was necessary to construct a system where the incentives are similar (to publish internationally and in peer reviewed channels), but not identical to the national model. Thus, it is evident that national systems are translated, negotiated and possible also contested on the local level. We also see clear evidence for strategic choices being made when indicators and systems are chosen. An example is KI which deliberately, and contradictory to the national system, choose to use whole number to encourage collaboration. Another strategic choice employed by HEIs in our sample is to broaden the variety of outputs measured in the system by giving points to a range of activities; for example the choice to award points to proceedings at LNU.

Evaluation systems are constantly under revision; many of the systems described here were either newly instated or under revision and a new Swedish system for the allocation of

resources on the national level based on peer review panels has recently been proposed by the Swedish Research Council (Vetenskapsrådet, 2014). This system should, if the Swedish government decides to follow the proposal, be used for allocating resources from the year 2018. As incentives from national systems have a tendency of 'trickling down' this new national system will undoubtedly influence allocation system at the university level.

We argue that in-depth and systematic knowledge about the actual use of bibliometrics across all levels of academia is pre-requisite for studying the effect of measurement. Our findings reveal that vast majority of all HEIs systematically apply bibliometric measures, a range of indicators are used, and academic research is measured on multiple levels. Further studies might, however, help us to understand how indicators on all levels, from university rankings to evaluation of individual researchers, reinforce, interact and contradict each other in the forming of a 'metric' culture in academia.

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[i] Data from http://www.uka.se/download/18.1c251de913ecebc40e780003405/1403093616367/annual-report-2013-ny.pdf.