BRIEF COMMUNICATION

Applying Successive H Indices in the Institutional Evaluation: A Case Study

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The present work shows the applying of successive H indices in the evaluation of a scientific institution, using the *researcher–department–institution* hierarchy as level of aggregation. The scientific production covered by the *Web of Science* of the researcher's staff from the Cuban National Scientific Research Center, during the period 2001–2005, was studied. The Hirsch index (*h-index*; J.E. Hirsch, 2005) was employed to calculate the individual performance of the staff, using the *g-index* created by Leo Egghe (2006) and the *A-index* developed by Jin Bi-Hui (2006) as complementary indicators. The successive H indices proposed by András Schubert (2007) were used to determine the scientific performance of each department as well as the general performance of the institution. The possible advantages of the method for the institutional evaluation processes were exposed.

One of the most recent observations carried out regarding the widely discussed *h-index* (Hirsch, 2005) has called attention to the possibility of using this index as a basis for the calculus of a series of H indices. Recently, Schubert (2007) proposed a successive *h-index* for the *journal–publishing group–country* hierarchy, where the *h-index* of the journals (h_1) determines the *h-index* value of each publishing group (h_2), and this determines the *h-index* value of each country (h_3).

The proposal turns the *h-index* into an evaluative indicator of the publishing activity, in a simple and objective form, which minimizes some of the limitations that habitually influence the use of the Journals Impact Factor (Garfield, 2007). Schubert's (2007) successive H indices showed the development of publishing groups from the United States, England, The Netherlands, and Germany, with a wide coverage in Thompson Scientific databases.

In the same article, Schubert expressed the idea of using successive H indices in the evaluation of networks from institutions, countries, or other aggregation levels, and even used as a possible example the *researcher–institution–country* hierarchy.

Schubert's (2007) proposal always takes into account the researcher as a basic cell for the determination of the institutional impact. The use of a successive *h-index* as an indicator might influence the development of the intellectual capital of scientists and scholars, and it conditions the impact of the institutional, sectorial, or national scientific research to the development and international visibility of the institutional researcher's staff. Consequently, the incidence of specific individuals or isolated articles is minimized, and a more holistic and systemic vision from the evaluation processes of the scientific production is offered.

This study describes the use of successive H indices at a micro level, on a *researcher–department–institute* hierarchy corresponding to the National Scientific Research Center (CNIC) from Cuba.

As a sample, the researcher's staff from CNIC in the Year 2006, and their scientific production covered by the *Web of Science* (*WoS*) corresponding to the period January 2001 to December 2005, was chosen.

Table 1 shows the CNIC researcher's staff ranking, according to the *h-index* value (i-h_1). To define the ranking place in the parity cases, two alternatives to *h-index* were used: in a first level, the *g-index* (i-g) proposed by Leo Egghe (2006); in a second level, an indicator proposed by Jin Bi-Hui (2006) and recently named the *A-index* (i-A) by Ronald Rousseau (2006). Both indices are going to give a weight to the total amount of citations received by the most cited articles from a

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TABLE 1. The top 30 researchers from CNIC according to their *h-index* value during the period 2001–2005.

Rank	Name	Department	A	C	Cmax	CxA	*i-h*$_1$	*i-g*	*i-A*
1	Rosa M. Más Ferreiro	CPN	61	340	36	5,57	**11**	**16**	**18,6**
2	Roberto A. Menéndez Soto	CPN	14	136	36	9,71	**6**	**11**	**19,3**
3	Julio César Fernández Travieso	CPN	19	124	23	6,53	**6**	**10**	**15,5**
4	Lilliam C. Fernández Dorta	CPN	20	85	15	4,25	**6**	**9**	**12,3**
5	José Illnait Ferrer	CPN	20	101	23	5,05	**6**	**9**	**12,1**
6	Rafael Gámez Menéndez	CPN	24	106	19	4,42	**6**	**8**	**10,7**
7	Ricardo González Alvarez	CIO	17	69	12	4,06	**5**	**7**	**9,2**
8	Mirian Noa Puig	CPN	19	54	19	2,84	**4**	**6**	**10,2**
9	María de Lourdes Arruzazabala	CPN	15	51	15	3,40	**4**	**6**	**9,8**
10	Daysi Carbajal Quintana	CPN	16	54	15	3,38	**4**	**6**	**9,8**
11	Vivian Molina Cuevas	CPN	16	53	15	3,31	**4**	**6**	**9,8**
12	Javier Campos Gómez	Biotecnología	7	36	12	5,14	**4**	**6**	**6**
13	Sarahí Mendoza Castaño	CPN	18	52	19	2,89	**4**	**5**	**8,8**
14	Silvia Menéndez Cepero	CIO	15	37	11	2,47	**4**	**5**	**6,5**
15	Yohani Pérez Guerra	CPN	5	42	17	8,40	**3**	**5**	**12,7**
16	Boris Rodríguez González	Biotecnología	7	28	12	4,00	**3**	**5**	**7,7**
17	Talena Ledón Pérez	Biotecnología	6	28	12	4,67	**3**	**5**	**7,7**
18	Rafael Fando Calzada	Biotecnología	7	30	12	4,29	**3**	**5**	**7,7**
19	Francisco Hernández Rosales	CIO	12	20	6	1,67	**3**	**4**	**5**
20	Karen Marrero Domínguez	Biotecnología	5	16	6	3,20	**3**	**4**	**4,7**
21	Edith Suzarte Portal	Biotecnología	4	14	6	3,50	**3**	**3**	**4,7**
22	Zullyt B. Zamora Rodríguez	CIO	8	15	6	1,88	**2**	**3**	**5,5**
23	Maritza F. Díaz Gómez	CIO	6	11	6	1,83	**2**	**3**	**5**
24	Blanca Rosa Hung Llamos	Biotecnología	3	6	2	2,00	**2**	**2**	**2**
25	Alina Falero Morejón	Biotecnología	4	7	2	1,75	**2**	**2**	**2**
26	Celso Pérez Bolaños	Biotecnología	5	8	2	1,60	**2**	**2**	**2**
27	Alejandro Perera Pintado	CIC	5	16	16	3,20	**1**	**4**	**16**
28	Víctor L. González Canavacciolo	CPN	6	13	10	2,17	**1**	**3**	**10**
29	Leonel Torres Aroche	CIC	2	16	16	8,00	**1**	**2**	**16**
30	Lidia Asela Fernández García	CIO	2	14	14	7,00	**1**	**2**	**14**

[a]Total of individuals on the researcher's staff from CNIC: 67 (January 2006).

A = Total of articles published during the period; C = Total of cites received; Cmax = Total of cites received by the most cited article; CxA = Average of cites by article; *i-h*$_1$ = *h*$_1$*-index*; *i-g* = *g-index* from Leo Egghe; *i-A* = *A-index* from Jin Bi-Hui.

researcher, an aspect which does not influence the value of *h-index*.

Table 2 shows the different departments or research directions which make up CNIC, in an order according to its *h-index* (*i-h*$_2$), which was defined by the rank number of the researcher with h_1 similar or over its ranking number. To determine the position within the departments, the highest h_1 reached by a researcher ($h_1$max) in each department was used. At the same time, using the same method, the value of the *h-index* from CNIC (*i-h*$_3$) was calculated, which is accompanied by the highest h_2 reached by one of its departments ($h_2$max).

The study of successive H indices at the micro level (*researcher–department–institution*) allowed us to reach the following conclusions:

- The combined calculus from the h_1, *g*, and *A* indices, based on citation analysis, allows the identification of researchers with a higher impact during the evaluated period, as well as the determination of its international visibility degree.
- The h_2 calculus allows the determination of the impact at the department level, with the aim of a comparative evaluation from the research made by the different departments or research directions, as well as the determination of the impact reached by CNIC, in an integral way.

TABLE 2. Ranking of CNIC departments according to h_2 value during the period 2001–2005, and h_3 value of CNIC.

Rank	Department	No. of Researchers	*i-h*$_2$	$h_1$max
1	CPN[a]	20	6	11
2	CIO[a]	12	3	5
3	Biotecnología[a]	10	3	4
4	Dir. Gral.	2	1	1
5	CIC[a]	4	1	1
6	CYTA[a]	8	1	1
7	Economía	1	0	0
8	DIRAMIC[a]	2	0	0
9	Química[a]	2	0	0
10	PPG	3	0	0
11	DGRHyRI	7	0	0
			h_3	$h_2$max
	CNIC	71	3	6

[a]Research departments.

i-h$_2$ = *h*$_2$*-index* from Schubert; *i-h*$_3$ = *h*$_3$*-index* from Schubert; $h_1$max = The highest *h*$_1$*-index* of each department; $h_2$max = The highest *h*$_2$*-index* value.

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- The obtainment of an h_3 value similar to the number of research departments could be the top goal to be achieved in the policy of institutional evaluation for a determined period.
- The behavior of h_3 during specific periods can be used to indicate the evolution of the scientific compliance from the researcher's staff of an entity.
- The institutional evaluation by using successive H indices offers an integral vision of the institutional researcher staff's behavior and its impact upon the international scientific community.

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Appendix A

Abbreviations Corresponding to the Departments Making Up the Cuban National Scientific Research Center

CPN	Centro de Productos Naturales (Center of Natural Products)
CIO	Centro de Investigaciones del Ozono (Ozone Research Center)
Biotecnología	Dirección de Biotecnología (Direction of Biotecnology)
Dir. Gral.	Dirección General (General Direction)
CIC	Centro de Investigaciones Clínicas (Clinic Research Center)
CYTA	Dirección de Ciencia y Tecnología Ambiental (Direction of Environmental Science and Technology)
Economía	Dirección de Economía (Direction of Economy)
DIRAMIC	Dirección de Diagnóstico Microbiológico (Direction of Microbiological Diagnosis)
Química	Dirección de Química (Direction of Chemistry)
PPG	Dirección de Producción (Direction of Production)
DGRHyRI	Dirección de Gestión de Recursos Humanos y Relaciones Internacionales (Direction of Human Resources Management and International Relationships)

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