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The role of the user in radical innovation: a global perspective

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Abstract

Innovation is the outcome of interactive learning between individuals and organizations regionally, nationally or globally. We expect that firms with open search strategies that seek knowledge from the external environment would also have superior performance in terms of innovation; Of those external sources, the users have traditionally be considered a key source of information for innovation. However, with few exceptions, the literature on open innovation and user-producer interaction has systematically neglected the geographical location of the user and its impact on innovation. This paper aims at contributing to this gap by studying the role of users not only nationally but also globally (both in the North and in the South), and their impact on radical innovations. The results indicate that using clients has a positive impact on introducing radical innovations, using local clients does not have a positive impact, in fact it is international users that matter most. Our results also shows, there is no difference in where the users are located either in high income countries (north) or middle/low income countries (south), what matters most is the capability of firms to detect potentially valuable knowledge, seek and exploit it.

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The role of the user in radical innovation: a global perspective

Abstract:

Innovation is the outcome of interactive learning between individuals and organizations regionally, nationally or globally. We expect that firms with open search strategies that seek knowledge from the external environment would also have superior performance in terms of innovation; Of those external sources, the users have traditionally be considered a key source of information for innovation. However, with few exceptions, the literature on open innovation and user-producer interaction has not paid attention to the international users and its impact on innovation. This paper aims at contributing to this gap by studying the role of users not only nationally but also globally and their impact on radical innovations. The results indicate that using clients has a positive impact on introducing new to the work innovations, using local clients does not have a positive impact, in fact it is international users that matter most. Our results also shows, there is no difference in where the users are located either in high income countries or middle/low income countries , what matters most is the capability of firms to detect potentially valuable knowledge, seek and exploit it.

1. Introduction

No firm innovates in isolation! Scholars in the innovation system tradition (Freeman, 1987, Lundvall, 1992, Nelson, 1993) have long considered innovation as the outcome of interactive learning between individuals and organizations embedded in regional or national systems of innovation. In order to introduce new products to the market, firms need to move from traditional “ivory tower” innovation to more “open innovation” and interact continuously with their external environment (Laursen & Salter, 2006; Grimpe & Sofka, 2009; Frenz & Ietto-gillies, 2009; Leiponen & Helfat, 2010), as knowledge derived from a variety of *external sources* will increase the likelihood of introducing innovations.

User-producer interaction becomes one of the most important vehicles for learning in the innovation process (Lundvall, 1988; Castellacci, 2008). Market-orientated strategies shows a change of perception on customers as active actors involved in creation and modification of products (Atuahene-gima, Slater, & Olson, 2005; Grabher, Ibert, & Flohr, 2008; Potts et al., 2008). Therefore, firms are increasingly improving their methods to access external knowledge embedded in costumers, through online contests and communities, lead user projects etc. (Jeppesen & Laursen, 2009; Poetz & Pru, 2010; Poetz & Schreier, 2012).

For economic geographers and international business scholars firms drive heterogeneous knowledge and benefit by being embedded in an *external environment*, which will have an impact on their innovation performance. Although the first stream has emphasized on the localized learning process through the spillovers of tacit knowledge in geographical proximity and clustering (Asheim & Isaksen, 2002; Weterings & Boschma, 2009) the latter has shown the competitive advantages derived through internationalization and *dual local embeddedness* (Jensen & Pedersen, 2011; Meyer, Mudambi, & Narula, 2011).

In a globalizing competitive world, customers have access to a variety of suppliers from around the world with a variety of choices, therefore firms must pay more attention to retaining the costumers worldwide and no longer only considering the domestic user (Malmberg & Power, 2005). To our knowledge, the discussion on the role of the user on innovation has been mainly focused on the geographical proximity of user and local demand (e.g. Fabrizio & Thomas, 2012; Weterings & Boschma, 2009), therefore devoid of any consideration about *global demand* and location of the user or the producer and its implications for innovation (exception

Laursen, 2011). Most of the literature on the role of the user in innovation is based on evidence of producers located in the advanced economies and the analysis of the users does not go beyond the traditional classification in local/regional, national and international (Asheim & Isaksen, 2002; Fabrizio & Thomas, 2012; Weterings & Boschma, 2009). Whether the global users are located in advanced or developing economies remains to be studied and their impact investigated.

It is often argued that firms located in developing countries lack the necessary technological capabilities to introduce new to the world innovations (Fagerberg, Srholec, & Knell, 2007). Despite the rapid accumulation of capabilities in some emerging economies (Arora and Gambardella, 2005), most firms in developing countries find it very difficult to move from new to the firm to new to the world innovations, in particular for product innovation (Kim and Nelson, 2000; Zhou and Xin, 2003; Srholec, 2008). However, recent research has shown that some firms in emerging economies are becoming new to the world innovators (Altenburg, Schmitz, & Stamm, 2008) thus pointing out to certain changes in the global distribution of labor between advanced and emerging economies in terms of innovation.

In this paper we will argue that in a globalizing market, firms cannot only focus on the local demand derived from their locality, furthermore with the expansion of emerging market and a growing purchasing power, costumers are no longer restricted to advanced economies. This paper *aims* at exploring the impact of international users on the degree of novelty at a global scale. Particularly, we want to investigate: 1, Are firms using international clients more likely to introduce new to the world innovations? And for this matter we make a distinction between advanced economies and emerging economies.

For answering to the above question, the paper draws on a unique set of firm-level data collected in 2010 in a variety of European countries, Brazil, China, India and South Africa. The questionnaire collected data on the collaboration with the user for innovation attending to their geographical location. The data allows the researcher to distinguish between local, national and international and, regarding this last one, between North America, South America, western Europe, Central and Eastern Europe, Africa, Japan and Australasia and Rest of Asia.

The paper is structured as follows. In the next section we review the literature on search strategies and open innovation paying particular attention to the role of the user in innovation. In section 3 we present the data in which the analysis is based. Section 4 presents the main results and we conclude the paper with some discussion and further research.

2. Theoretical framework

2.1. Users and degree of novelty

For scholars in the innovation system literature (Freeman, 1987, Lundvall, 1992, Nelson, 1993) innovation is the result of interactive learning between individuals and organizations embedded in a certain national or regional system of innovation (Asheim, 2005; Asheim and Gertler, 2005; Cooke et al., 1997; Cooke and Morgan, 1998; Nightingale, 1998). Searching for external knowledge available beyond “firm boundaries” has an impact on product development and innovation (Katila & Ahuja, 2002; Rosenkopf & Nerkar, 2001). Firms benefit from having an “open” search strategies, that use not only internal resources but also external sources, such as clients, suppliers, competitors, consultants, universities (Laursen & Salter, 2006).

The role of the user as a source of innovation has been long discussed in the literature (Blazevic & Lievens, 2008; Castellacci, 2008). Through user collaboration organizations learn, meet customer requirements better and improve performance (Alam, 2002; Blazevic & Lievens, 2008; Oliveira & von Hippel, 2011). In a theoretical paper, Malmberg and Power discuss that in a globalizing world where costumers have a broad number of suppliers; innovation processes are increasingly “demand-driven”. (Malmberg and Power, 2005).

Users are an important source of knowledge in the development of both incremental (Lundvall, 1992; Asheim & Isaksen, 2002; Jensen et al, 2007) as well as radical innovation (Lettl, Herstatt, & Gemuenden, 2006).

Scholars mainly within economic geography have paid attention to the role of domestic user and impact of geographical proximity on innovations. Asheim & Isaksen (2002) have illustrated the role of local users on incremental innovations within the ship industry in Norway. Weterings and Boschma (2009) using firm-level data on user–producer interactions of Dutch software firm, show that although spatial-proximity would facilitate interaction, it does not impact firm’s innovation output in terms of radical innovations (Weterings & Boschma, 2009). Other studies

shows that demand patterns in the firm's home country has more influence on innovation in comparison to foreign demand (Fabrizio & Thomas, 2012). In a very recent study Laursen (2011) using data from the Danish innovation survey shows that local users are important for incremental innovation while global users seem to be more important for radical innovation. Management scholar have paid more attention to the specific type of users, mainly "lead users" and their impact on innovations (Franke, Hippel, & Schreier, 2006).

2.2. National capabilities & innovations

Using external knowledge can be hindered in two ways; one is the limitation caused by the lack of ability to recognize the potential value of an external knowledge: absorptive capacity (Cohen & Levinthal, 1990) and geographical limitations (Jaffe, Trajtenberg, & Henderson, 1993; Fabrizio & Thomas, 2012). While former refers to the ability of firms to recognize the potential value of an external knowledge, the later implies the advantages or disadvantages derived through knowledge spillovers via geographical proximity.

Firms need to have the absorptive capacity to realize the potential of an external knowledge based on prior experiences, acquire it but also assimilate it for commercial use (Cohen & Levinthal, 1990). In this respect it is uncontestable that firms located in high-income countries always rank higher than other countries in terms of investment in R&D and innovation, number of researchers and innovation output (UNCTAD, 2006; 2007; Srholec, 2008) and that national conditions affect the capacity of firms to innovate (Fagerberg and Srholec, 2009; Srholec, 2008; Arora, 2006; Chaminade and Vang, 2008).

While it is true that the technology clubs in the world had remained stable in the last five decades (Castellacci and Archibugi, 2008) this may be rapidly changing. Between 1990 and 2000 China already moved to the more advanced followers cluster (Castellacci and Archibugi, 2008), and in 2010 the share of total global R&D spending of China was 12,2 %, at the same level as Japan, but still below US and Europe (Battelle, 2011).

The changes in emerging economies have motivated a change of strategy in the multinationals from Advanced locating innovation activities in the developing countries, or in other words a shift from from asset exploiting to asset seeking (Arora and Gambardella, 2005; Arora, 2004; Castellani and Zanfei, 2006; Sabiola and Zanfei, 2009).

Before, markets in the developing countries were seen as a way to diffuse innovations that had been developed in the advanced countries. With the capabilities built in these countries, more MNCs are locating innovation activities in the emerging economies to tap into new pools of knowledge and benefit from a large pool of qualified human capital at a lower cost (Arora, 2006; Schmiele, 2012; (Manning, Massini, & Lewin, 2008). With the capabilities built in these countries, the strategy of MNCs has changed to asset seeking and therefore the role of advanced users in Asia becomes also more important.

This catching up in research infrastructure has been in parallel with an increased degree of technological sophistication of the users. Asian users are considered technologically very advanced in various sub-industries, particularly with regards to electronics (Yeung, 2007). Ernst (2005) for example argues that “Global firms emphasize the need to relocate design to be close to the rapidly growing and increasingly sophisticated Asian markets for communications, computing and digital consumer equipment, to be able to interact with Asia’s lead users of novel or enhanced products or services”.

3. Data

3.1. Survey and data base

This research project relies on a survey conducted across nine countries. Data on firms in Europe were gathered from leading economies with a per capita income above US\$ 45.000 per year, namely Denmark, Germany, Norway and Sweden. Estonia, a transition economy was also polled¹, as well as four prominent middle-income countries: Brazil, China, India and South Africa. The choice of countries allows a clear comparison between economies that are global leaders and ones that are largely followers in the global arena. The survey for each country

¹Estonia is an unusual case, based in Europe but with a similar level of development as the middle-income countries. It contributes only 17 out of 1215 data points, and does not meaningfully affect the results.

focused on either ICT, automotive or agro-processing², whichever sector was of economic importance in that country.

Table 1: Survey results by country and industry (number of responses; response rates in brackets)

Countries	ICT	Auto	Agro	TOTAL
Brazil		69 (25.9%)		
China	243 (2.7%)			
Estonia	17 (14%)			
India	324 (20.2%)			
South Africa			84 (16.9%)	
TOTAL middle-income countries	584 (5.34%)	69 (25.9%)	84 (16.9%)	737 (6.32%)
Denmark			49 (23.3%)	
Germany		53 (4.7%)		
Norway	181 (11.9%)			
Sweden	171 (10.3%)	24 (14.3%)		
TOTAL high-income countries	352 (11.05%)	77 (6.18%)	49 (23.2%)	478 (10.59%)
Total	936 (6.59%)	146 (10.64%)	133 (18.58%)	1215 (7.5%)

The information gathering also took place in a variety of different ways. In countries with a culture of participating in surveys, e.g. the Scandinavian countries, firms were sent a link to an online tool. In the middle-income countries, data gathering was done best telephonically or through face-to-face interviews. In all sectors and across all countries 1215 responses were collected. However, as some questionnaires were incomplete in some key variables for the purpose of current study, observations were dropped reducing to a total of 1017 firms in total.

Table 1 offers a summary of the results received from each sector and each country, the number of responses and response rates. The combined sample was dominated by ICT responses. Although China has the second-highest number of responses, it also has the lowest response rate (2.7%). This is because the Chinese team had opted to choose a broader sample and use a less labour-intensive strategy for targeting respondents. The low German response rate is most likely

²Sweden had both auto and ICT surveys.

due to the fact that the questionnaire was sent out during a period when the German automotive industry was struggling with the aftermath of the economic crisis.

3.2. Non-response bias check:

For each country, the two subsets of respondents and non-respondents in terms have conducted a t-test for firm size, the results indicate that in case of Germany and Estonia, the sample is not representative. In both case, small firms are less likely to have international activities.

Furthermore non-respondent firms had been contacted for a feedback on reasons of not answering the survey, and the results indicate that the survey had not been relevant to them!
Germany: small firms are less likely to have international activities

3.3. Variables

Dependent Variable

The dependent variable for this research is based on a question that asks firms if the last three years (2006-2008) they have a products or services new to the world, industry or firm. As we are interested in degree of novelty, the variable is a categorical, taking value 1 for firm innovation, 2 for new to the industry innovations, and 3 for new to the world innovations. Although firms could have chosen more than one category, we have only counted for the highest type of innovations. It must be noted, firms would answer to the question on sources of innovation, only in the case of having had an innovation, therefore no innovation does not have any indications in with regard to the sources of innovation.

Independent Variables

As mentioned above, clients are seen as one of the external sources of innovation. In table 1 external sources with regard to their degree of importance as a source of innovation have been illustrated. Users have been indicated as the main external source of innovation.

Table 1- use of external sources of innovation

Used sources	Frequency	%
Clients	798	72%
Suppliers	669	60%
Competitors	410	37%
Consultancy groups	440	40%
Government	380	34%
Universities	413	37%

In our analysis we have used the following variables to study the impact of users on radical innovations. The part related to users as a source of innovation is based on a question in the questionnaire that asks the geographic location of clients. We have categorized the focal firm and global collaborations into middle/low income and high income, which are generally defined as following:

low/middle income countries- Brazil, India, China, South Africa, Estonia

high income countries- Sweden, Denmark, Norway and Germany

International clients- low/middle income countries : clients located in middle/low income regions: South America, Central & Eastern Europe, Africa, and Rest of Asia

International clients- high income countries: clients located in high income regions: North America, Japan & Australasia, and Western Europe

Explanatory variables

Variable		type
<i>Region</i>	1: firm is in high income 0: firm is in low/middle income countries.	dummy
1, <i>Client collaboration</i> 2, <i>Local client</i> 3, <i>International client</i>	1: yes 0: no	3 separate dummy variables
Region-intll client	0: firms in middle income without intll clients collaboration 1: firms in middle income with intll clients collaboration 2: firms in high income without intll clients collaboration 3: firms in high income with intll clients collaboration	Categorical variable
Region-Mclient	0 Firm in H income collaborated with clients in M income 1 Firm in H income not collaborated with clients in M income 2 Firm in M income collaborated with clients in M income 3 Firm in M income not collaborated with clients in M income	Categorical variable
Region-Hclients	0 Firm in H income not collaborated with clients in H income 1 Firm in H income collaborated with clients in H income 2 Firm in M income not collaborated with clients in H income 3 Firm in M income collaborated with clients in H income	Categorical variable

Control variables

Although this study examines the impact of clients as sources of innovation on firm's ability to introduce radical innovations, we also control for the technological input from universities or through R&D activities inside the firm. We have created two dummy variables: *university as a source of collaboration* and *R&D*.

The firm's characteristics can also influence the ability to introduce radical innovations, therefore we control for size, organizational form, and industry.

Size: Categorical variable, based on the answer to question, full-time equivalent (FTE) employees in the enterprise. Small takes value zero if fewer than 10 FTE employees or 10-49 employees, medium takes value one if 50 to 249 employees, large takes value 2 if 250 to 999 employees or 1000 or more employees, has been chosen.

Organizational form: Categorical variable, takes value zero if "a standalone company", value one if "a subsidiary of an MNC", value two if "the headquarters of an MNC".

Industry: Categorical variable, takes value zero if "ICT", value one if "automobiles", value two if "agro-food".

Export market: if the main market has been based on export, to control for the effects that has been derived from being internationally market driven.

5. Results

Descriptive statistics:

The questionnaire has one question that asks about development of the most important innovation of your firm in the last 3 years and with whom and in which geographical location they have collaborated with.

Table two shows the correlation between all independent variables, apart from the categorical variables made as an interaction of region of focal firm with region of clients. It must be noted variables with high correlation are due to interactions or are subcategories of a more general variable. Furthermore they are not in the same models.

Table 2- Descriptive statistics (n:1103)

	mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13
1 product innovation	1.873864	.7351092	1.00												
2 Client Collaboration	.8397727	.3670253	0.0852	1.00											
3 Intl Client	.3965909	.4894679	0.1866	0.3541	1.00										
4 Local Client	.7170455	.4506907	-0.0083	0.6953	-0.0477	1.00									
5 Dummy-Mclients	.2477273	.4319381	0.1523	0.2507	0.7078	0.0040	1.00								
6 Dummy-Hclients	.3340909	.4719399	0.1642	0.3094	0.8737	-0.0418	0.5032	1.00							
7 Firm region	.3875	.4874564	-0.0889	0.0676	-0.1394	0.1216	-0.2349	-0.0886	1.00						
8 University collab	.4420455	.4969123	0.1341	0.2204	0.2326	0.1375	0.2472	0.2136	-0.1068	1.00					
9 Export Market	.3193182	.4664776	0.1176	0.0998	0.5459	-0.1650	0.4821	0.5226	-0.1996	0.2149	1.00				
10 R&D	.6307339	.482883	0.2713	0.0498	0.1914	-0.0203	0.1601	0.1871	-0.2242	0.1495	0.1903	1.00			
11 size	.8229885	.8286722	0.0971	0.0348	0.2097	0.0101	0.2544	0.2156	-0.4226	0.1848	0.2265	0.2315	1.00		
12 orgform	.5145518	.7294729	0.1440	-0.0869	0.1564	-0.0670	0.1872	0.1546	-0.3572	0.0864	0.1750	0.2427	0.3931	1.00	
13 industry	.2984055	.6297615	-0.0423	-0.0802	-0.0412	-0.0764	-0.0463	-0.0603	0.0455	-0.0440	-0.0499	-0.1667	0.1345	-0.1289	1.00

Model:

In order to analyse the effect of clients from middle and low income countries on degree of novelty, a categorical variable, we chose to run an mlogit model with new to the firm as the baseline. Post-estimation tests are in favour of the model.

Table 3. Results of the logit model

Variable	model1		model2		model3		model4		model5	
	industry	world	industry	world	industry	world	industry	world	industry	world
Client Collaboration	0.48**	0.34								
	(0.237)	(0.289)								
Firm region	-0.70***	0.17	-0.68***	0.21						
	(0.201)	(0.240)	(0.201)	(0.243)						
Intl Client			0.45**	0.75***						
			(0.214)	(0.249)						
Local Client			0.16	-0.17	0.17	-0.11	0.13	-0.17	0.16	-0.12
			(0.200)	(0.231)	(0.201)	(0.234)	(0.201)	(0.233)	(0.202)	(0.236)
region-intll client					0.26	0.09				
					(0.258)	(0.314)				
region-intll client					-0.77***	-0.37				
					(0.231)	(0.296)				
region-intll client					-0.12	1.20***				
					(0.334)	(0.356)				
region_Mclients							-0.03	-0.79*		
							(0.481)	(0.454)		
region_Mclients							1.04**	-0.68		
							(0.507)	(0.501)		
region_Mclients							0.56	-0.85*		
							(0.486)	(0.471)		
Dummy-Hclients							0.25	0.49*		
							(0.230)	(0.263)		
region_Hclients									0.68**	1.43***
									(0.347)	(0.364)
region_Hclients									0.82***	0.32
									(0.226)	(0.284)
region_Hclients									0.70**	-0.04
									(0.324)	(0.398)
Dummy-Mclients									0.47*	0.55*
									(0.256)	(0.294)
University collab	0.36**	0.41*	0.37**	0.41*	0.38**	0.46**	0.34*	0.44**	0.36**	0.44**
	(0.179)		(0.179)		(0.180)		(0.180)		(0.180)	
Export Market	-0.02	0.32	-0.19	-0.07	-0.18	-0.02	-0.22	-0.06	-0.20	-0.01
	(0.196)		(0.228)		(0.230)		(0.233)		(0.235)	
R&D	1.15***	1.22***	1.14***	1.18***	1.12***	1.09***	1.15***	1.17***	1.11***	1.10***
	(0.180)	(0.221)	(0.180)	(0.222)	(0.181)	(0.225)	(0.180)	(0.223)	(0.181)	(0.225)
Medium	-0.23	0.08	-0.21	0.10	-0.21	0.11	-0.19	0.08	-0.20	0.11
	(0.226)	(0.269)	(0.226)	(0.271)	(0.227)	(0.273)	(0.227)	(0.271)	(0.228)	(0.273)
Large	-0.30	-0.14	-0.32	-0.12	-0.29	-0.06	-0.35	-0.14	-0.31	-0.09
	(0.253)	-0.137	(0.254)	-0.121	(0.254)	-0.058	(0.255)	-0.138	(0.256)	-0.093
Subsidiary	0.16	0.36	0.07	0.21	0.10	0.31	0.04	0.24	0.10	0.30
	(0.227)	0.364	(0.230)	0.208	(0.231)	0.310	(0.231)	0.243	(0.232)	0.304
Headquarter	0.70**	0.83**	0.67**	0.82**	0.67**	0.81**	0.67**	0.78**	0.68**	0.83**
	(0.300)	(0.346)	(0.299)	(0.346)	(0.299)	(0.347)	(0.299)	(0.347)	(0.299)	(0.347)
Industry dummies (3)	YES	YES	YES	YES						
_cons	-0.68**	-2.05***	-0.48*	-1.78***	-0.42	-1.52***	-1.04**	-0.81	-1.20***	-1.83***
	(0.277)	(0.352)	(0.255)	(0.320)	(0.261)	(0.327)	(0.523)	(0.518)	(0.248)	(0.303)
N	840		840		840		840		840	
chi2	131.69		139.47		151.93		143.54		154.62	
ll	-823.22		-819.33		-813.10		-817.29		-811.75	
pseudo R2	0.0741		0.0784		0.0854		0.0807		0.0870	

legend: * p<.1; ** p<.05; *** p<.01

The results of model I indicates that clients matter as a source of innovation for new to the industry innovations. Furthermore firms in middle income countries (region) are more likely o have new to the industry innovations. However, as shown in model II collaboration with international clients has a high impact on new to the world innovations, whereas local clients do not have any significant impact. This is also in line with previous studies that had shown local resources do not impact the likelihood of firms introducing radical innovations (Laursen, 2011; Weterings & Boschma, 2009).

Model III shows the likelihood of using international clients for firms in high income countries and middle income countries, although in this model we cannot interpret a positive or negative impact of using clients for middle income countries, Model IV and V are clearer in this regard.

Model IV shows that firms no matter the location that have used clients in M-income countries are more likely to have new to the world innovations. Model V indicates, firms from technologically advanced countries are more likely to have new to the world innovations, once collaborated with clients from advanced countries.

Robustness checks:

1, we have run the models only on a sub-sample of firms that have had at least one international clients and the overall results with regard to the impact of international clients on the likelihood of introducing more novel innovations will still hold.

2. As it might be argues that Africa as a continent is a low income region, we have run the analysis by excluding this region, and results will remain the same. Indicating clients

6. Concluding remarks (to be completed)

The result of this study shows that although using global clients has a positive impact on new to the world innovation, it is not enough; as firms also need to have the capabilities of first detecting the potential value of external knowledge for acquiring and then having the capabilities for bundling and leveraging. Firms from advanced countries as in comparison to firms from emerging economies have higher abilities to use the knowledge required from clients in the developing countries. Furthermore, firms in advanced economies that have used clients in emerging economies, are more likely to have new to the world innovations compared to those that have not had any collaborations

(to be developed)

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