Entrepreneurial universities in less innovative regions: problems and solutions



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Innovative and research activities within universities are increasingly linked with regional socio-economic conditions and innovative capacities of local business. In less innovative Russian regions, though, prospects for mid-range universities might be limited due to poor research quality and the lack of mutual trust between Academia and industry. In this paper university-level data are analysed in relation to regional innovative development. Despite gross heterogeneity within the sample, the findings suggest that research and commercialization propensities are likely to be shaped by the type of university, its proactive approach and internal structure rather than regional settings. Mid-range universities might consider less formal ways to contribute to regional innovation systems, which is more in line with 'engaged' rather than 'entrepreneurial' university approach.

Keywords: regional innovation systems, entrepreneurial universities, mid-range universities, regional technology transfer.

erception of higher educational institutions (HEIs) as engines for regional growth has preoccupied the minds of scholars and policymakers for a considerable timespan already, while the 'Triple helix' model has marked the departure from an 'ivory tower' university to a proactive entrepreneurial entity. Taking cue from the international trend umpteen political initiatives in Russia have emphasized government support aimed at augmenting 'innovativeness' of universities and local industry. Moreover, imposed publication and R&D intensity requirements, higher salaries demanded by academic staff as well as student mobility have deemed purely teaching functions increasingly unsustainable. This poses a challenge for HEIs, especially in less innovative regions where the divergence between Academia and industry is quite pronounced and opportunities for technology transfer are limited due to relatively weak entrepreneurial milieux.

This research attempts to determine to what extent regional socio-economic conditions and absorptive capacity of local business modify innovation potential of mid-range HEIs and how the latter can contribute to regional and local innovation systems in less innovative Russian regions. The rest of this paper is structured as follows. The first section offers a regionalized perspective on HEIs' entrepreneurial activities and links HEIs' research performance to the overall level of innovative activity within the home region. In the following section methodology and data employed in the research are presented. The next section presents quantitative data analysis of Russian HEIs and discusses major findings. The penultimate part highlights the implications of the study and suggests solutions for mid-range HEIs, and the last part concludes.

Regionalized perspective

Increasing engagement of higher educational institutions in regional and local innovation systems was prompted by the processes of governance devolution undergoing in developed nations, the European Union is but one prominent example. Since regions have accrued more institutional and economic autonomy, innovative development through HEIs has been increasingly embraced by local authorities, especially in economically troubled regions or those undergoing industrial restructuring like

Wales and Scotland in the UK [10], Southern Italy [4], Andalusia in Spain [17] and Värmland region in Sweden [12] among others.

In contrast, Russian higher education system is generally regulated on the national level, however downward dynamics of federal funding are likely to put pressure on regional mid-range HEIs due to severe competition on national education 'financial' market. Those HEIs which find it tough to vie for grant and contest funding with larger and metropolis universities are pressed to seek for non-budgetary financing from other sources. At the same time, HEIs are obliged to meet research intensity requirements and encouraged to engage in technology transfer, and they are more likely to do so locally due to societal accountability issues and long established formal and informal contacts. Regional outlook then makes sense and provides a functional framework for the explication of HEIs' collaborative and commercialization activities.

HEIs' involvement in regional economies stems from personal and informal contacts which are a powerful source of academic knowledge transfer to private firms in itself, while spatial co-location plays a prominent role in technology transfer and establishing of universityindustry links (UIL). Plentiful anecdotal evidence from developed and developing countries alike testifies for HEIs' engagement with business and authorities on subnational level. Some authors on the demand side propagate for shared cultural values and historically established cooperative ties between universities and industry over spatial co-location, but still empirical evidence suggests that innovative firms are more likely to source knowledge from local HEIs [22]. Indeed, the number of technological start-ups is positively correlated with (thought not ascribed to) spatial proximity of universities, while academic spin-offs have strong 'Alma Mater bias' [ibid]. Moreover, HEIs' economic impact is extremely regionalized in terms of (high-skilled) employment and provision and training of human capital for regional economy. Up to 80 per cent of university graduates in Russia are employed within the same macroregion where they obtained their degrees, while for less developed regions the share oscillates around 50 per cent [16]

It is generally assumed that HEIs' ability to commercialize academic research results is contingent on the absorptive capacity of local firms and technological activities proliferating in local economy [13]. Demand for complex academic knowledge is associated with higher patent and R&D intensity of local business, and neighboring R&D-intensive firms are more likely to establish mutually rewarding UIL [3]. Hence, the presence of established industrial value chains and advanced industries (e. g. biotechnology, optoelectronics, etc.) in a region is likely to further augment absorptive capacities in local firms and facilitate integration of academic and research institutions in regional and local innovation systems [13, 19].

Less innovative firms possess limited capabilities to absorb 'semi-finished' academic research results and gravitate towards more 'applied' equipment and software acquisition, which is exactly the case for less innovative Russian regions where the divergence between academic institutions and industrial organizations is quite pronounced [15]. There still remain collaborative ties between research institutions and industry taken over from the Soviet period, those are, however, scarce and insufficient as only 5 per cent of research conducted in HEIs is commercialized and implemented in production [18]. The major hypothesis of the study, thus, summarizes findings from the broad body of empirical research concerned with regional and industrial absorptive capacity and links HEIs' innovative activities and contribution to regional and local innovation systems to the overall level of socio-economic and innovative development within their locale.

Methodology and data

The methodology in the remainder of this paper employs mixed methods and incorporates both qualitative and quantitative data collection and analysis. The qualitative part is premised on the content review of public documentation regarding higher education system and S&T development in Russia. The quantitative side relates to the analysis of individual HEIs' research and innovation performance. HEI-level data for 2014 are retreated from HEIs' efficiency monitoring conducted and made freely available by the Ministry of Education and Science of Russian Federation [16]. The sample comprises 113 regional universities ranked on the basis of Regional Innovation development rating conducted by the Higher School of Economics [9]. The ranking assigns regions to four broad groups according to the overall level of regional innovativeness defined by regional socio-economic conditions, regional scientific and research potential, innovative activity of local business and quality of regional innovation policy. Similarly, universities are assigned to group I, II, III or IV according to the innovation tier of the home region. State, federal, national research universities as well as polytechnic HEIs are included in the sample which makes for one or two universities representative of each region. To control for the inflation of HEIs' performance indicators in the upper group, universities based in Moscow (including the Moscow region) and Saint-Petersburg are excluded from the sample. Tier I, thus, contains only four universities located in the Republic of Tatarstan and Kaluga region, which are subjoined to group II for the sake of convenience.

HEIs' innovation performance is defined by research outputs of academic staff, overall research intensity and established university-industry links. Research output of selected HEIs is captured by conventional quality performance indices (QPI) of scientific database publications per 100 academic staff. The share of R&D earnings in HEI's total income, non-government R&D incomes and absolute number of grants obtained per 100 academic staff proxy HEIs' research intensity. HEIs' orientation towards entrepreneurial activities and collaboration with industry is measured by the share of royalty incomes from intellectual property (IP) management in total income and the number of graduate training and employment agreements with local employers. Patent counts of individual HEIs are not included due to the dearth of annualized data.

Regional innovative development and HEIs' performance

Before proceeding to the quantitative analysis of selected HEIs' innovative and research performance it is worthwhile considering the overall profile of regional HEIs. Most Russian universities can be classified as 'mid-range' if one adopts the definition provided by Wright (2008) and appropriated by Gal and Ptacek [5]: '[m]id-range universities are most often located in nonmetropolitan regions... where the R&D potential and density of contacts are much lower and possible spillover effects emerge more sparsely'. In this research universities which fall under tier III and tier IV according to Regional innovative development ranking could be classified as midrange. Those are universities located in regions lagging behind in socio-economic conditions, business innovative intensity and the quality of social capital and where commercialization opportunities are rare if compared to, say, tier I and II universities. Table 1 provides qualitative characteristics of a typical Russian mid-range HEI and average metrics based on the Ministry of Education and Science efficiency monitoring data [16].

In general, statistics of selected HEIs are rather perplexing and offer quite a number of compelling findings (Table 2). At first glance, IP management and non-budget R&D income share in total income tend to fall with downgrading innovation tier, however the tyranny of averages and gross heterogeneity within groups has to be catered for. The relation seems more obvious for the type of university: research metrics (publication rates, grant funding) and IP management income share are higher for national research universities (NRUs): these are more research-intensive by definition and tend to actively engage in recent cluster initiatives promoted by the Ministry of Education and Science. Federal universities (FUs), at the same time, display higher publication rates which might be ascribed to participation of most federal universities in '5-100' project where publication and citation indices are major QPIs. FUs tend to be more 'grant-intensive' as well: the finding corroborates the view that larger HEIs located in core and metropolitan areas possess a competitive edge in grant contests, while smaller mid-range HEIs are squeezed from national 'education

Parameter	Metric/characteristic		
Location	Capital/secondary cities in less innovative/peripheral regions (tier III, IV)		
Number of full-time students	4000-6000		
Number of academic staff	350-600		
Number of researchers (academic staff with degree):	250-450		
Academic staff salary compared to regional average:	1,3-1,4 times higher		
University–industry links:	Moderate/limited		
Match of regional economy and university's profile:	Moderate		
Regional demand for research and innovation:	Moderate/low		

Table 1 Characteristics of Russian mid-range universities [16] financial market' and pressed to seek non-budgetary financing sources [2]. Moreover, federal universities generally focus on teaching and basic research and tend to be less engaged in commercialization activities, which is reflected by a meagre share of IP management and nonbudgetary R&D incomes.

In the meantime, polytechnic HEIs should have an edge over humanitarian and classical universities in terms of 'marketable' research results and cohesion with local industry needs. The former should thus be able to secure enough funding with large-scale industrial contracts [2]. This logic, however, seems inverted in reality: with rare exceptions (success stories like Tomsk Polytechnic University) technologically oriented HEIs display higher R&D intensity and publication rates against lower IP incomes. The structure of research outputs minted by universities and academic staff is more or less uniform across different regions: much research goes into public domain while both parties are generally demotivated to commercialize research results (Fig. 1 and 2). Distorted motivation of academic staff is further augmented by publication and citation QPIs (also true for universities participating in '5-100' project), which in the absence of any interest on behalf of local business takes a toll on regional technology transfer.

Despite gross heterogeneity within groups the disparity between second- and forth-tier universities is quite pronounced: those in peripheral and less innovative regions display lower research intensity, are inferior in research commercialization and tend to have fewer contacts with local industry (graduate training and employment agreements). At the same time, if universities are reassigned to groups based on sub-rankings of the HSE Regional innovation development rating (on the basis of business innovative activity, socio-economic conditions, etc.), no connection between the tier of a region and HEIs' research and innovation characteristics is obvious, unlike the connection between university type and its research performance.

Another issue is worth considering before proceeding to likely solutions. Concerning size metrics and citation indices the data provided by the Ministry of Education

Table 2 Qualitative characteristics of selected universities [16]

	II	III	IV	TECH	NRU	FU
WS and Scopus publications per 100 acad. staff	25,7	10,0	7,2	12,6	25,5	18,3
RSCI publications per 100 acad. staff	118,1	87,7	78,6	96,4	145,1	77,5
Grants per 100 academic staff	5,5	6,6	5,3	3,1	10,7	9,2
Non-budget R&D incomes per acad. staff, thousand rub.	108,7	48,1	39,6	84,4	248,1	92,4
Non-budget R&D in- comes in total income, %	13,0	7,2	7,4	10,4	18,2	7,6
IP incomes in total income, %	5,1	1,2	0,6	2,7	9,5	0,9
Graduate training and employment agreements	263	131	68	167	162	617

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RAS RESEARCH INDUSTRIAL UNIVERSITIES ACADEMIC INSTITUTES RESEARCH INSTITUTES

Fig. 2. Share of academic and research staff eager to capitalize on commercial research [18]

Fig. 1. Structure of research outputs in Russian research organizations [18]

and Science monitoring are quite reliable, however when it comes to research intensity and IP management indicators the numbers evoke well grounded doubt. What do Russian HEIs actually report under IP management incomes? Licensing and spinning off technology is the least preferable technology transfer channel for Russian universities and industry alike, while most mid-range HEIs secure licensing incomes according to the data provided by the monitoring. Worth noting anyway is the fact that mid-range HEIs are not able to live off incomes stemming from licensing and other technology transfer activities. Due to industrial structure and varying maturity of regional industry these opportunities might be limited; even if localized innovation takes place, some industries innovate without external R&D and might have no interest in establishing UIL whatsoever [11].

Entrepreneurial universities: problems and solutions

While there is a variety of knowledge distribution channels, formal ones are usually lionized in national S&T policies. If successful, commercialization of academic research might generate momentous outcomes in terms of local high-skilled employment and additional income for HEIs, but in many cases revenues generated by TTOs barely cover the costs. Local business in Russia is hesitant to establish commercial ties with universities due to the lack of proper IP rights and royalties distribution mechanisms, while universities fail to perceive technology transfer as a source of monetary income and mostly employ research to secure additional grant funding. This lack of mutual dialogue results in divergence between the level of technology and research produced by universities and ready-made solutions required by industry; indeed, a mismatch between R&D activities of research organizations engaged in technology transfer and de facto industrial innovation is quite common for Russian regions [14].

Notwithstanding the findings, mid-range HEIs can still amplify their contribution to local economies and generate spill-overs in regional innovation systems; recently, strategies other than commercialization have been emphasized by HEIs in developed countries. Those include 'softer forms' of UIL: collaborative research, consultancy of academic staff, tailored courses or educational programs, multifarious training arrangements with local employers and transfer of PhDs and Master students to regional jobs as a major channel of academic knowledge spill-overs [20]. A glimpse at funding structure of universities in Russia hints at those 'softer' UIL: universities retrieve substantial funding from business while less than 10 per cent can be tracked down to contract research (Fig. 3 and 4). Regional HEIs might just as well perform 'public space functions' [21] and provide services linked to regional and urban economic matters, which is more in line with 'engaged' rather than 'entrepreneurial' university approach. Among others, Tomsk State University actively engages in urban



planning and territorial development, while start-ups at Tyumen State University specialize in R&D support for local industries (petrochemical, geological, information technology) and tackle broader regional issues (ecology, rational use of natural resources and energysaving).

The recent cluster initiative promoted by the Ministry of Education and Science has stimulated intra-regional cooperation between universities and local industry. There are more incentives for HEIs to choose large and medium-sized enterprises (LMEs) over smaller firms as cooperation partners due to established informal links and larger financial gains: LMEs are more likely to engage in collaborative research and invest in universitybased infrastructure and equipment. Indeed, funding of university laboratories by large companies is a usual practice in other countries [1]. LMEs as cooperation partners are recognized by academic staff as well, while 'third party funding' offers salient increase in their income. In this light, boundary-spanning national programs are desirable, like Israeli MAGNET, Faraday Partnerships in the UK or BRIDGE in Norway, however as anecdotal evidence suggests Academia and industry leaders might work out mutually favorable collaboration terms on their own. Staunch support on behalf of local authorities and holistic approach is requisite for local innovative development, while government initiatives should aim at institutionalizing successful practices in lieu of imposing them ab extra.

For classical universities, 'technologization' and 'marketization' look like a pretty straight-forward strategy to appeal to industry. Classical HEIs can contribute to regional and local innovation systems in a variety of ways due to their broad discipline base and 'semi-technological' orientation [2]. This scenario, however, has equivocal outcomes while applied research might not provide for the needs of local industry but undermine traditional research function of HEIs [4]. To append research functions to traditional teaching midrange HEIs might prefer to engage in cooperation with other HEIs within the same or in neighboring regions to create critical research mass, as is the case with Tomsk education development cluster. In regions willing to step on the path of innovative development, undergoing economic restructuring or industry upgrading, though, developement of graduate programs compatible with those emerging calls of regional economy might be universities' best strategy [21].

Conclusion

This research attempts to contribute to ample literature dedicated to 'entrepreneurial' universities with quantitative analysis of HEIs' research performance and its determinant factors in Russian regions with different innovation potential. It is clearly not enough for HEIs to be located in fertile milieux to become innovative or entrepreneurial, and overall socio-economic development of the region is of secondary importance. Moreover, 'equating 'research excellence' in universities with the ability of a regional economy to support innovation' [6] might undermine traditional research functions and result in haphazard and loosely formulated goals. Selected few universities can be attributed a tag 'entrepreneurial' and exude tangible economic impact in the home-region. For the sake of comparison, in the European Union only 10 per cent of HEIs secure 85 per cent of total academic licensing incomes [3]. Thus, regions willing to step on the path of innovative development should embrace universities as a part, but definitely not the focal point of their innovation strategies.

Most importantly, capabilities of universities to create and capture commercial value hinges upon their proactive approach, organizational structure, internal enforcement of incentives and motivation of academic staff [21]. Building up the culture of trust between university and industry at a local level is another crucial aspect and is totally within the competence of both parties. Relying hopes on universities to become regional growth poles on their own is a no-win strategy, while synchronization of motivation and actions of all concerned parties, complex development of social infrastructure and facilitation of inra-regional links can ensure sustainable development and combat an outflow of students and skilled labor from peripheral to metropolitain regions.

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Предпринимательский университет: проблемы и перспективы региональных вузов

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В статье предпринят анализ показателей эффективности инновационной и исследовательской деятельности вузов в зависимости от уровня инновационного развития домашнего региона и инновационной деятельности локального бизнеса. Полученные выводы подтверждают рабочую гипотезу: в регионах с более низким уровнем инновационной деятельности университеты не склонны к коммерциализации результатов исследований, и местный бизнес неохотно сотрудничает с вузами. В менее инновационных регионах университетам следует использовать менее формализованные каналы включения в инновационные системы, что скорее соответствует подходу «вовлеченного», нежели «предпринимательского» университета.

Ключевые слова: предпринимательский университет, региональные инновационные системы, региональный технологический трансфер.

В России создана Ассоциация разработчиков и производителей электроники

13 июня 2017 года о начале своей работы объявила Ассоциация разработчиков и производителей электроники (АРПЭ). Объединение учреждено крупнейшими частными игроками электронной отрасли: холдингом GS Group, компаниями «Зелакс», «АТОЛ», «Завод "Эталон"» и «Связь инжиниринг», – еще более 30 предприятий заявили о готовности присоединиться к работе АРПЭ. В будущем Ассоциация объединит свыше 100 компаний. АРПЭ нацелена на развитие российской электронной промышленности посредством координации деятельности частных компаний и государства, усиления отраслевой кооперации, реализации профориентационных мероприятий среди молодых специалистов, дальнейшего увеличения экспортного потенциала и выхода на глобальный рынок.

Ассоциация разработчиков и производителей электроники станет главным информационным центром отрасли, представителем отраслевых интересов в органах государственной власти, инициатором и координатором крупнейших инвестиционных проектов. АРПЭ предоставит своим участникам эффективную площадку для обсуждения законотворческих инициатив, единых стандартов, последних отечественных разработок и продуктов. Учредителями Ассоциации выступили холдинг GS Group, «Завод "Эталон"», компании «Зелакс», «АТОЛ» и «Связь инжиниринг». Исполнительным директором АРПЭ назначен Иван Покровский, занимающий должность генерального директора «Информационно-аналитического центра современной электроники». Цель создания АРПЭ – консолидировать усилия бизнес-сообщества для реализации отраслевой стратегии, направленной на развитие российской электронной промышленности, становление национальных технологических чемпионов и укрепление их позиций на внутреннем рынке, дальнейший рост экспортного потенциала отечественной электроники и выход на мировой уровень. Среди первоочередных задач, стоящих перед участниками Ассоциации, – проведение комплексного анализа отрасли, разработка стратегии ее развития, оценка реальных возможностей отечественных предприятий, продвижение собственных предложений по регулированию отрасли в органах государственной власти, противодействие незаконной деятельности на рынке.

О готовности вступить в объединение заявили более 30 компаний, занимающихся разработкой и производством электроники, а также работающих в смежных областях. В ближайшие годы Ассоциация объединит более 100 ключевых российских предприятий электронной промышленности. Участие в работе АРПЭ поможет компаниям выстраивать партнерские отношения и объединяться в эффективно работающие цепочки, что позволит поэтапно восстанавливать и развивать в России разработку и производство оборудования, компонентов и материалов. Важнейшим направлением работы Ассоциации станет содействие интеграции российских производителей в проекты по обеспечению ускоренного цифрового развития российской экономики, в том числе в программу Национальной технологической инициативы.

В настоящее время в составе Ассоциации оформился ряд комитетов: комитет по регулированию внутреннего рынка, нацеленный на значительное увеличение доли отечественных производителей на российском рынке, международный комитет, содействующий выходу российских компаний на зарубежные рынки, комитет по контрактному производству, ориентированный на популяризацию и внедрение на предприятиях эффективных моделей контрактного производства, а также кадровый комитет, осуществляющий профориентационную деятельность в школьной и университетской средах и отвечающий за развитие кадрового потенциала компаний – участников АРПЭ. Ассоциация нацелена на расширение количества комитетов, направленных на решение актуальных для отрасли проблем.

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