Entrepreneurial universities in less innovative regions: problems and solutions

Perception 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

Keywords: regional innovation systems, entrepreneurial universities, mid-range universities, regional technology transfer.
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 university–industry 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 macro-region 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 retrieved 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 HEIs 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 non-metropolitan 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 mid-range. 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 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 non-budgetary 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

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Table 1

Characteristics of Russian mid-range universities [16]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Metric/characteristic</th>
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<tbody>
<tr>
<td>Location</td>
<td>Capital/secondary cities in less innovative/peripheral regions (tier III, IV)</td>
</tr>
<tr>
<td>Number of full-time students</td>
<td>4000-6000</td>
</tr>
<tr>
<td>Number of academic staff</td>
<td>350-600</td>
</tr>
<tr>
<td>Number of researchers</td>
<td>250-450</td>
</tr>
<tr>
<td>Academic staff salary (academic staff with degree)</td>
<td>1.3-1.4 times higher</td>
</tr>
<tr>
<td>University–industry links</td>
<td>Moderate/limited</td>
</tr>
<tr>
<td>Match of regional economy and university’s profile</td>
<td>Moderate</td>
</tr>
<tr>
<td>Regional demand for research and innovation</td>
<td>Moderate/low</td>
</tr>
</tbody>
</table>

Table 2

Qualitative characteristics of selected universities [16]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>TECH</th>
<th>NRU</th>
<th>FU</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS and Scopus publications per 100 acad. staff</td>
<td>25.7</td>
<td>10.0</td>
<td>7.2</td>
<td>12.6</td>
<td>25.5</td>
<td>18.3</td>
</tr>
<tr>
<td>RSCI publications per 100 acad. staff</td>
<td>118.1</td>
<td>87.7</td>
<td>78.6</td>
<td>96.4</td>
<td>145.1</td>
<td>77.5</td>
</tr>
<tr>
<td>Grants per 100 academic staff</td>
<td>5.5</td>
<td>6.6</td>
<td>5.3</td>
<td>3.1</td>
<td>10.7</td>
<td>9.2</td>
</tr>
<tr>
<td>Non-budget R&amp;D incomes per acad. staff, thousand rub.</td>
<td>108.7</td>
<td>48.1</td>
<td>39.6</td>
<td>84.4</td>
<td>248.1</td>
<td>92.4</td>
</tr>
<tr>
<td>Non-budget R&amp;D incomes in total income, %</td>
<td>13.0</td>
<td>7.2</td>
<td>7.4</td>
<td>10.4</td>
<td>18.2</td>
<td>7.6</td>
</tr>
<tr>
<td>IP incomes in total income, %</td>
<td>5.1</td>
<td>1.2</td>
<td>0.6</td>
<td>2.7</td>
<td>9.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Graduate training and employment agreements</td>
<td>263</td>
<td>131</td>
<td>68</td>
<td>167</td>
<td>162</td>
<td>617</td>
</tr>
</tbody>
</table>
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 energy-saving).

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 university-based 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. Stauch 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 mid-range 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, development 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 intra-regional links can ensure sustainable development and combat an outflow of students and skilled labor from peripheral to metropolitan regions.

References

В России создана Ассоциация разработчиков и производителей электроники


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