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COMMUNICATING COMPANY INNOVATION CULTURE: ASSESSMENT THROUGH JOB ADVERTISEMENTS ANALYSIS

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COMMUNICATING COMPANY INNOVATION CULTURE: ASSESSMENT THROUGH JOB ADVERTISEMENTS ANALYSIS[4]

The paper explores the composition of researchers' skillsets in an innovation-driven environment from the perspective of employers. The authors analyze the relation between skills requirements described in job advertisements for researchers and the presumed innovation culture of companies. The study is based on job advertisements content analysis and in-depth interviews with chiefs of research and development companies. It uses biotechnology industry as an example as it is one of the fastest-growing and innovation-driven sectors globally. Authors used data from Russian, as well as Canadian, UK and USA job search engines to consider international context. Empirical findings demonstrated that skills composition stress on hard skills more frequently and detailed, while soft skills are often a "must have without saying". The same is for digital skills that are assumed to be essential in high-tech companies globally and therefore not fully specified in job ads. There is a certain mismatch between skills presented in the ads and articulated in the interviews as employers tend to demonstrate innovation-friendly company culture for possible applicants. The present paper enriches literature on skills assessment, giving comprehensive lists of biotech skills in-demand divided into soft and hard categories. In addition, it provides the new insight into employee skills articulated by the companies as a strong element of organizational innovation climate.

Keywords: knowledge economy, open innovation, company innovation culture, biotechnology, skills

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Introduction

The concept of knowledge economy is discussed for almost two decades now as the current generation of economy, which boosts countries national economic performance by means of drawing upon peoples' knowledge and competencies applying knowledge. This understanding has become widespread among the academic, business and political community. The knowledge economy is featured by a strong presence of knowledge-intensive activities in manufacturing and services, which draw strongly on technical and scientific knowledge and enhance diffusion and refreshment of any type of knowledge that contribute to an accelerated pace of technological and scientific advance. Consequently, the meaning of knowledge and intellectual capabilities increases over physical assets and natural resources (Powell and Snellman, 2004). One central assumption is that the knowledge economy thinking forces companies redesigning their organizational models to exploring more efficient ways to leverage employees' knowledge and competencies. This is well in line with another assumption, which is the shift towards life-long learning and rethinking the links between work and learning. Still, the challenge to overcome established work routines and arrangements as well as ownership and control over knowledge appear among the main constraints (Burton-Jones, 2001).

Development of knowledge and competency-driven strategies is not sufficient enough to empower corporations or countries to be competitive in the global dimension. Achieving the latter requires a broader effort including profound understanding of knowledge and competencies required for companies and countries paired with the respective models to employ and develop them. Hence, skills and competencies are central for companies especially in order to keep momentum for sustainable economic success, which can be traced back to the need for company innovation.

Having said this, it becomes obvious that a broad range of competencies and skills are required to master the challenges arising from these developments. In the first instance, the demand for low-skilled labor is shifting towards higher skilled labor reasoned in the changing competencies required to use and generate knowledge and technology as argued by Berman et al 1994 already. Using technology, however, still requires the human factor. It is not operating for its own sake but needs to be fine-tuned and targeted towards selected results eventually leading to increased productivity of labor. This in turn requires complementary labor skills' for targeting the use of technology.

It is utmost important to provide labor a reasonable environment which stresses the importance of competencies and skills but beyond recognizes the desire of people for creative unconventional work allowing them to break routines and enter new paths. In other words, companies expect innovation as one output of peoples' work, innovation that is targeted at user acceptance while at the same time companies may find it challenging to encourage employees breaking with routines and rules in order to succeed with innovative activities. This is all part of the innovation culture and climate of an organization and reflected in the competency and skills profiles of company employees (Sarpong et al., 2015). Even more company innovation climate lives with employees, e.g. individuals who all possess unique sets of competencies. It is frequently observed that a group of individuals will be more creative and innovative as a whole if the individuals possess complementary but not identical skills, which are in a sense at arms-length that is thought to be one main precondition that individuals take each other serious and develop trust. In this decisive regard, soft skills comprehension becomes a more complicated subject to investigate rather than hard that are trained in comparably short time.

Soft skills are traits, abilities and experiences of an employee, which to some extent depend on the individual and therefore are difficult to generalize and to codify although they are well received and respected. It appears that companies many times assume that employees possess a soft skill, the latter being codified and communicated using very general descriptions

and terms, but experience shows that often the so communicated demand for soft skills rarely reflects the actual demand and provides a mismatch with the innovation culture which is really in place in the daily company operations. Furthermore, the meaning and scope of soft skills extended over the last decade in pair with diffusion of information technologies, namely social media. This clearly goes beyond the common perception of digital skills as ICT literacy and ICT use often measured in terms of the number of ICT devices in use. In the authors understanding, however, ICT literacy and use are standard routines but digital skills also include competencies of communication, e.g. providing information as well as searching and processing information. Against the standard communication routines which were dominated by oral communication, the digital age brought a stronger presence of written information. The latter includes not only scientific, engineering and technical information but also the communication of private information even by using messenger services and similar. While the communication style has changed significantly, the communication nowadays is also stored for a long time and often accessible for other people than the initially intended target person(s). This requires a change in individuals' communication style, be it in the use of words but also the awareness of the potential outreach of information disclosed in the digital environment and last but not least information management techniques and approaches (Meissner et al., 2016).

Besides these soft skills people are confronted with the fact that new information and knowledge is developed in shorter cycles and communicated accordingly. This clearly implies that this knowledge needs to be absorbed also at higher speed. Thus skills like efficient reading of large amounts of information, abstracting and synthesizing information and knowledge as well as targeted search together with targeted codification are crucial. With no doubts these competencies are required for long time in the research profession but still a while ago the amount of information available was less overwhelming. Accordingly researchers need to complement their qualitative information analysis skills with quantitative analytical skills. Furthermore, the diminishing borders of science and engineering fields and the emergence of new overlapping fields requires broader views on research, e.g. interdisciplinary work. Although this is frequently quoted to being a valuable competency, little has been elaborated what this actually means. In the context of the paper interdisciplinary skills strongly refer to:

- the competency of understanding the subject specific language used in different fields of research,
- finding a compromise between different backgrounds,
- possessing the personal strength to raise questions,
- ask for explanation by dedicated experts in the field, and
- demonstrate respect and appreciation of works done in other research areas.

Although this is an easy saying, reality demonstrates that such competencies are often not fully or only partially developed still this competency turns out elementary for living an innovation and research culture within an organization which shows sustainable results. For this reason organizations are frequently looking for employees who are open-minded and willing to accept competencies by others and share own competencies for the sake of results instead of aiming at maximizing their own personal advantage.

Against this background, the paper aims to analyze the changing composition of skillsets for innovation in a high technology environment. It distinguishes hard and soft skills demanded by companies. We limit the empiric work to the biotechnology sector as one of the world's fastest-growing industries that requires highly skilled labor. To understand the international context we include Canada, the United Kingdom, the United States of America and Russia in our analysis. This assures comparison of countries at different development stages, which influence companies' innovation activities, thus the innovation culture. The authors argue that companies often claim that the organization lives an open innovation culture inside the organization, empowering employees to enter new paths and try the unusual whereas their search for talent

contradicts these statements. However, in the authors view these announcements and companies' self-perception is contradicted partially in job announcements aiming at highly skilled talent. Furthermore, job announcements vary strongly in the introduction of skills desired by potential employees between countries.

The paper proceeds as follows. First, a literature review provides insight into recent academic works about employee skills followed by the introduction of methodology used. The next section introduces findings, and the last one discusses these findings and provides conclusions.

Literature Review

In the strategic intent 'innovation' is perceived as a driver for the creation of new knowledge, which is in turn among the main ingredients for innovation (Acs et al., 2002; Strambach, 2002). This observation stems back to the early works in the 20th century which were mainly focused on the meaning of innovation for economic development, e.g. macroeconomic considerations. Bell (1973) found that theoretical knowledge is central as a source of innovation and Romer described the iterative nature of knowledge use and new knowledge creation which is included in the innovation process (e.g. new growth theory in economics described by Romer, 1986, 1990). Science in turn is considered one major source of new knowledge (Machlup 1962) which opens new windows for solving problems, understanding phenomena and so on which even results in the emergence of industries (Porat, 1977, Stanback, 1979, Noyelle, 1990). Accordingly, an ongoing debate about the future of labor market in scientific literature, media and among policy-makers had emerged for more than half of a century ago. There is a consensus that todays and future changes in employment are not only driven by rapid technological advancements, but also by increased globalization and changing demographics (Karoly & Panis, 2004; Wilson & Hogarth, 2007). Long-term influence of these main drivers results in significant structural shift in demand for goods and services and the nature of jobs (e.g., destruction of repetitive task jobs, increased gap between low- and high-skilled labor, the rise of remote work, longer working lives due to ageing workforce etc.). In this situation of constant changes, the value of adequate skills assessment and prediction of labor market structure becomes increasingly acute, as the costs of skills mismatch are substantial not only for individuals, but for employers and the national economies (OECD, 2016).

Skills prediction exercises has a history of over fifty years, and originate from first attempts of US Bureau of Labor Statistics to apply advanced modification of "manpower requirements approach" to anticipate national future of employment. Today, governments in all developed economies apply labor-forecasting exercises, although they vary a lot in terms of methods, skills definition, frequency, scope and resource-intensity. Methodologies currently used include a broad range of techniques, such as statistical and econometric analysis, employers and employee surveys, Foresight, Delphi methods, scenario development, skills audits, content analysis of job advertisements, different combinations of them and many more (European Training Foundation, 2012).

Being an inseparable part of skills prediction qualitative projections evolved from simple extrapolation to complex multi-sectoral models, which are the basis of "best practice" methodologies worldwide (see Bureau of Labor Statistics, 2016; European Centre for the Development of Vocational Training, 2012; UK Commission for Employment and Skills, 2016). Such methodologies aim to produce a comprehensive overview of structural economic changes and technology affecting occupational composition of the labor market. The top-down approach used there includes six successive steps: labor force demographics, aggregate economic growth, input-output balance, output and employment by industry, occupational employment and job openings (Bureau of Labor Statistics, 2016). Other qualitative sources of labor market

information are employer surveys, surveys of graduates employability, vacancy analysis, forecasts of industry sector organizations etc. that are basically aimed at short-term identification of labor shortages or surpluses and skills mismatch (e.g. Migration Advisory Committee, 2008; Bartlett, 2012; UK Commission for Employment and Skills, 2010). Quantitative methods are also widely applied, although less restricted and more speculative than econometric models, especially if statistical data for econometric modelling are scarce or inadequate. These include mainly relying on expert panels, sectoral round tables, Delphi methods that allow reaching consensus about possible future scenarios (Mabotja, 2013; Wilson, 2012; Castiglioni & Tijdens, 2014). Finally, recent advancements in methodologies represent a holistic approach of combining raw figures and expert perception to overcome shortcomings of separately used techniques.

- Many aspects of labor market projections has been widely criticized.
- *Results accuracy*: Short- and medium-term forecasting is apparently more precise than the ones with twenty years horizon. However, even 5-10 years period is quite long from the perspective of labor market participants (e.g. developing educational strategies, hiring or making decisions regarding investments in employee training, etc.) (Centre for Spatial Economics, 2008).
- *Practicability* of national macro-level forecasts is broadly questioned, because hiring takes place at the regional level, where national projections may turn out irrelevant. Furthermore, after the global financial crisis there has been a steady trend of extensive critique of macroeconomic models for simplifying the reality, taking into account only on rational expectations, and being detached from the real problems of the economy.

Given the volatility of the economy, the accuracy of forecasts, according to the critics, has not improved significantly in course of time (Oller, Barot, 2000; Fildes, Stekler, 2002). This happens due to the desire to describe the economic processes in strict mathematics, which result in a mechanistic approach to forecasting (Nureev, 2014). Some researchers insist on limited use of labor forecasts due to market self-regulation. It is argued that labor market participants decide who to hire or what skills to develop, whether or not forecasting exercises are conducted in the country or region. In addition, some argue that projections have limited influence on policy-making: regulators can only create more education opportunities but not prepare certain number of specialists (Canadian Council on Learning, 2007). This argument is reasonable, given the difficulties in determining the parameters of education required for a particular profession (Castley, 1996), especially in conditions of instability and accelerating technological progress.

An aspect that gained increased attention more recently is that quantitative predictions of labor market lack detailed description of skills required (hard and soft skills, methods and technologies used). STEM (science, technology, engineering and mathematics) group of skills take center stage in studies as the importance of research and development is increasingly recognized as a driver of national competitive performance (Karkkainen &Vincent-Lancrin, 2013). Results of skills monitoring pose a great value, still only selected publications provide a comprehensive overview of researcher's top skills (see, e.g. Shmatko, 2016). Monitoring exercises represented in articles largely cover skills composition for IT specialists (Lee, 1995; Gallivan et al 2004), as methods used are mainly automatic gathering of job advertisements from topical websites, content analysis, web mining and text mining. Therefore, it appear to be a research done by IT specialists for IT specialists.

A great amount of publications survey soft skills universal for all employees (Heckman & Kautz, 2012). The prime source of skills monitoring is media, e.g. "The hottest skills research" by professional social media service LinkedIn (LinkedIn Official Blog, 2016). The rankings of the most desired skills are composed annually and based on the analysis of hiring and recruiting activity occurring within a year period. The top skills lists consist predominantly of ICT skills. Cloud and distributed computing, statistical analysis and data mining consistently occupy

leading positions and that apparently corresponds to the trends of the Big Data era. Such skills as mobile development, retail payment and information systems development, network and information security, search engine optimization/search engine marketing are stable in demand. The chances are such combination of skills reflects the increased interest of candidates in jobs in high-tech companies from "best employers" category, such as Apple, Salesforce, Facebook, Google, Amazon, Microsoft, Uber, Unilever, Tesla, Airbnb, Netflix (Linkedin Lists, 2016).

Obviously, literature aims at projecting labor demand but there is little attention being paid to the match of skills and competencies with the company innovation culture. Therefore, skills and especially soft skills need to fit with the company innovation ecosystem to explore labor potential fully. Hard skills are certainly an asset but if the internal innovation ecosystem is restrictive and hierarchical companies find it difficult to motivate employees towards creativity and risk taking – both are essential ingredients for successful and sustainable innovation.

Methodology

The study combines two methods:

1. analysis of job advertisements in biotechnology and
2. in-depth interviews with chiefs of organizations that carry out R&D projects in biotechnology.

The basic assumption of the first part is that job advertisements content is valid to represent employer's view on ideal skillset of an employee[5]. There were two sources for job advertisements analysis: job postings aggregator indeed.com to identify top required skills in biotech on the international market (vacancies from USA, Great Britain and Canada were included) and Russian job postings aggregator hh.ru to carry out a comparison and identify whether requirements in R&D converge. These two websites were selected among other job search engines because they collect data not only from related websites (general and topical, including those specialized in biotechnology), but also from other aggregators. A software on Python was developed to extract texts of job advertisements in biotech sector. The next step was to compose a thesaurus, where skills were split into three categories:

- "professional education and training" aggregating fields of education that might be required to work in biotech R&D companies;
- "hard, special skills and abilities" containing special competencies, requirements as to relevant experience, knowledge of methods and techniques;
- "soft, general skills and abilities" related to personal characteristics of employees, subtle behaviors and communication styles.

Thesaurus also include columns with synonymous and categorical relations where possible. Then, according to composed thesaurus, relevant skills were extracted and ranked highest to lowest by frequency. The same procedure was adopted to the texts of vacancies in Russian and then results translated into English.

In such a way, texts of 1436 job advertisements in biotechnology sector available on 12 November 2016 on indeed.com were extracted and processed — 990 from USA, 111 from Canada and 335 from Great Britain. The sample from the Russian job search engine hh.ru included 289 job postings related to biotechnology sector available at the same time.

A series of in-depth interviews were conducted approximately at the same time. The interviewees represented Russian R&D companies and university research centers that conduct

[5] It should be noted that our study does not deal with biotechnology market size or wage levels estimation and investigates into skills and competencies solely.

projects in biotechnology, namely in medical biotechnology, pharmacology, food biotechnology and agricultural biotechnology. In total 16 representatives from R&D intensive companies and 11 from university research centers were interviewed. All interviewees hold the highest managerial position and are responsible for corporate strategies. Interviews used a structured interview guideline, where aspects of human resources policy where emphasized, namely:

- key criteria when hiring for R&D position (hard and soft skills, degree, narrow specialization, relevant experience etc.);
- perception of labor demand-supply balance in an organization and in biotechnology sector as a whole;
- skills anticipation in the short-term due to fastest-growing areas of biotechnology.

Interviews were transcribed and respondent responses were encoded. Then, significant trends in responses were identified and illustrating citations were selected. For reasons of confidentiality the names of interviewees and organizations remain anonymous.

Findings

The most important results of the study concern employer's perception of in-demand skills and competencies to drive company's innovative development. Hard and soft skills analysis from job advertisements is accompanied by citations from in-depth interviews. It should be pointed out that for the purpose of the study skills lists for biotech include names of methods and techniques, e.g. PCR, as well as names of concepts to which they relate, molecular biology techniques in this case. This allows to understand employer's perception on candidate's skillset better, as well as to identify certain technological trends if a technique is frequently mentioned (like PCR or HPLC).

Job postings have similar structure and generally include job description, key responsibilities and qualifications/requirements. Our analysis focused more on the last-mentioned section. Comparative scanning of job advertisements on two websites revealed that, in general, Russian vacancies are not described in such a detail as international ones in terms of knowledge of narrow disciplines or experience of certain techniques application (Table 1 shows in-demand skills in biotechnology by categories).

There is a significant group of vacancies, where the requirements list is reduced to just several items:

- field-specific education (typically, it is specified as education in one of the fields: biology, chemistry, medicine, pharmacy, veterinary medicine and biotechnology), only one third of job ads included requirements as to academic degree;
- advanced computer skills;
- language skills: good written and spoken English (in order to read professional literature and write description of methods);
- communication skills.

In contrast, a wide range of disciplines may be mentioned in requirements to professional education and training in job postings found on indeed.com (Fig.1).

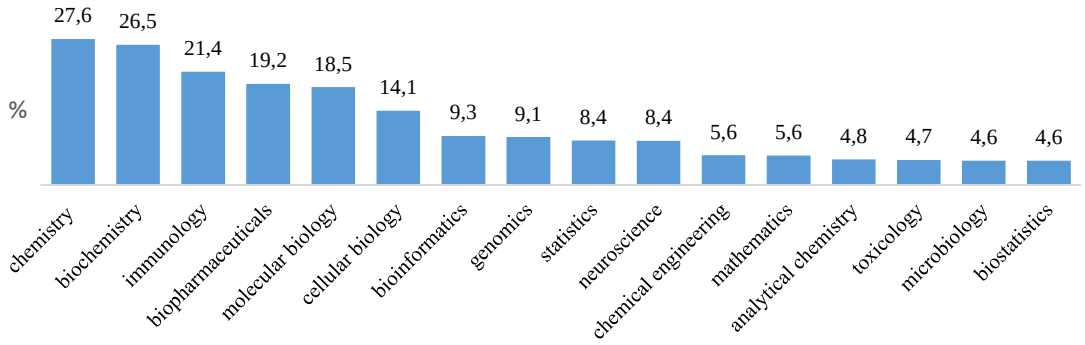


Fig. 1. Requirements to the scope of education in biotechnology job advertisements in Canada, UK and USA, % of job ads

Canadian, UK and USA employers are more specific in terms of degree sufficient for the position. About a half of job ads contain requirements to PhD or bachelor's degree (fig.2).

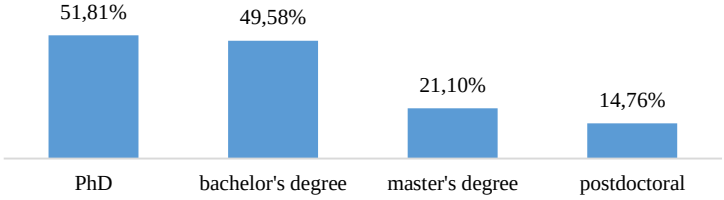


Fig. 2. Requirements to the education level in biotechnology job advertisements in Canada, UK and USA, % of job ads

Table 1. Results of job advertisements analysis: top required skills in biotechnology

Skills category	Canadian, UK, US job advertisements	Russian job advertisements
Hard, special skills and abilities	1. Experience in drug development. 2. Instrumentation skills related to quality control and quality assurance. 3. Purification techniques. 4. Biological and medical data analysis. 5. Process development skills. 6. Assay development skills. 7. PCR (polymerase chain reaction). 8. Sequencing methods. 9. Antibody discovery technologies. 10. Statistical analysis. 11. Knowledge of GLP (Good laboratory practice) guidelines. 12. In-vivo technologies. 13. Flow cytometry. 14. Chromatography. 15. HPLC (high performance liquid chromatography). 16. ELISA (enzyme-linked immunosorbent assay). 17. MSD (Mass Selective Detection). 18. Cloning techniques. 19. Spectrometry.	1. Knowledge of GMP (good manufacturing practice) guidelines. 2. Knowledge of regulatory standards, guidelines, including the State Pharmacopoeia of the Russian Federation, the European Pharmacopoeia, the United States Pharmacopoeia. 3. Strong knowledge of analytical chemistry. 4. Research laboratory experience. 5. Biological and medical data analysis. 6. PCR (polymerase chain reaction). 7. HPLC (High performance liquid chromatography). 8. Molecular biology techniques. 9. Culture techniques. 10. Literature reviews and analytical materials preparation. 11. Statistica. 12. Experience in preparing grant applications and reporting documents. 13. ELISA (enzyme-linked immunosorbent assay).

		14. Chromatography. 15. Project management. 16. Validation of analytical methods and procedures. 17. Experience in conducting preclinical/clinical research. 18. Microbiological methods. 19. Physical and chemical techniques.
Digital skills	1. Knowledge of biomedical information analysis tools. 2. Knowledge of analytical systems (LIMS). 3. MS Excel. 4. Python. 5. SQL. 6. Matlab. 7. Perl. 8. R. 9. C++. 10. Linux.	1. PC skills. 2. MS Office. 3. Statistica. 4. MatLab. 5. SPSS. 6. Knowledge of biomedical information analysis tools. 7. R. 8. Biological database skills. 9. Python. 10. Familiarity with cloud-based platforms.
Soft, General skills and abilities	1. Team-working skills. 2. Organizational skills. 3. Communication skills. 4. Self-motivation. 5. Time management. 6. Critical thinking. 7. Working under pressure. 8. Multi-tasking. 9. Complex problem solving. 10. Judgment and decision-making.	1. Communication skills. 2. Language skills: ability to read and translate professional literature, to write description of methods in English. 3. Being rigorous and accurate. 4. Responsibility. 5. Team-working skills. 6. Organizational skills. 7. Attention to detail. 8. Compliance. 9. Proactivity. 10. Systems skills, critical thinking.

The shift in biotech towards seeking for specialists with interdisciplinary academic background instead of narrowly focused individuals corresponds to the world's recent life sciences workforce trends. This changes in human resources policies and revision of in-demand skillsets is due to interdisciplinary nature of biotechnology itself, as well as the latest acceleration of science convergence (namely, nanotechnology, biotechnology, information, and cognitive science) (box 1).

Box 1. Biotech is interdisciplinary

In biotechnology, a good specialist possesses knowledge in many spheres. In our organization, we do not have narrowly focused specialists. If a researcher deals with genetics, for instance, there cannot be a situation when he is separated from other fields. In our organization, we do not perform research only in cytology; we also deal with anatomy, as well as examine callus tissue development. Narrow specialists are not nearly as effective as their wide-profile colleagues.
R&D company specialized in plant biotechnology

As it is evident from the results of vacancy analysis, international employers tend to mention a greater variety of biotechnology techniques in hard skills section while use of broad categories, like "knowledge of analytical chemistry" is not so common. Biological and medical

data analysis is ranked high in both lists, which is in line with rapid rise of bioinformatics and exponential growth of volumes of data produced that have been observed over the past years. Therefore, skills of integrating data to a format that can be used to make research decisions experienced prominent growth in demand. Still, job postings lack mentioning requirements to analysis toolset (e.g., programming skills or administering databases): only Statistica software package is frequently included. Advanced computer skills turn to be the number one in Russian hard skills list, but the concept in fact relate to working with Microsoft Office package, the Internet and web-searching. However, when speaking about IT and digital skills in the interviews, the heads of Russian biotech companies tend not to admit the possibility to outsource complex data processing (box 2). As long as digital tools become irreplaceable in addressing such problems, as streamlining data analytics, optimization of targeted therapies development, speeding up clinical trial enrollment etc., perception of IT and digital competencies in Russian biotech is likely to change and demand for it to boost.

Box 2. IT skills perception

IT and digital skills are obligatory for every researcher. An outsider with lack of specific knowledge in biotechnology should not process raw experimental data.
University lab specialized in food biotechnology

Knowledge of international standards and regulatory documentation seem to play a crucial role when hiring for a position in Russian biotechnology sector: knowledge of GMP guidelines and world pharmacopoeias are in top-3 requirements to the candidates. In addition, Russian biotechnology at its stage of development needs specialists with excellent skills of preparing grant applications and reporting documents. When discussing key hiring criteria in the interviews, top-managers generally expressed common opinion that advanced professional competencies, practical skills, publication list and previous experience in biotechnological projects matter the most. Other idea that dominated among CEO's in biotech is that only enduring academic enthusiasm will help employees remain successful in the field (box 3).

Box 3. Motivation comes first

Academic interest is a key. Money is a bad motivator in R&D.
R&D company specialized in biophysical research

Rankings of soft, general skills and abilities appear to contain similar items, but the composition is different and supposedly express perceptions of organizational culture in R&D companies. Team working, organizational and communication skills, which are essential to almost any employee in the modern economy, are commonly top-ranked, which is also clear from face-to-face communication with employers (box 4).

Box 4. Soft skills matter a good deal in R&D

Communication skills are important, because many graduates now face problems of teamwork. Research teams are heterogeneous, especially in biotechnology manufacturing, and include biologists as well as technical staff. The latter usually possess mechanical intelligence while the first tend to have special philosophic view towards research objects. In fact, biological objects are living and sometimes the results of work are unpredictable. It is essential to be flexible and use imagination.
University lab specialized in agricultural biotechnology

It is noteworthy that requirements in Russian job postings often contain such skills as being rigorous and accurate, responsibility, paying attention to detail, compliance (ability to follow strict instructions) as in biotechnological or pharmaceutical manufacturing process standards compliance is vital. Failing to keep up with regulatory requirements in this industry may create very costly problems (box 5).

Box 5. Responsibility is one of the most important traits of an employee in biotechnology

One of the core traits of an employee in biotech is strong sense of responsibility. We produce drugs for the national vaccination schedule, vaccines and probiotics for children. Failure to comply with instructions may have very serious consequences.
R&D company specialized in immunobiology

Employers from USA, UK and Canada tend to seek candidates who possess advanced skills of individual work – self-motivation, time-management, multi-tasking, judgment and decision-making; compliance and result-orientated performance seem to go without mentioning.

Discussion of soft skills and employer's perception on labor demand-supply balance led to uncovering yet another in-demand skills group, which might be called "intermediary" (box 6).

Box 6. Bridging the gap between science and business requires special skills

The problem supposedly typical of biotech sector is that there is a wide gap between the results of fundamental research and consumer's needs. I would call them innovation managers – specialists who facilitate transition from fundamental science to its applied use, who would understand how inventions could be converted into a product and its market opportunities. Scientists and business people with few exceptions have different attitudes of mind and motivations. The first are mainly driven by academic interest, the others – more focused on profit making. We need someone who would understand them both and foster cooperation.
R&D company specialized in medical biotechnology

Finally, the interviewees were also asked to anticipate at least short-term course of biotechnology development and list the most promising areas, which will create demand for specialists. Bioinformatics and computational biology, gene engineering, molecular biology, biophysics, biochemistry, as well as functional nutrition (especially elderly) and cellular biotechnology were top-rated (box 7).

Box 7. Promising areas for future biotech development

The profound impact of computational biology on biotechnology development is out of the question, it's obvious. One of the prospective areas is neurointerfaces. Knowledge of higher nervous activity, biophysics, electronics, as well as prosthetics will be high in demand. The other important directions in which specialists will be needed are health diagnostics and monitoring, personalized medicine.
R&D company specialized in molecular biology

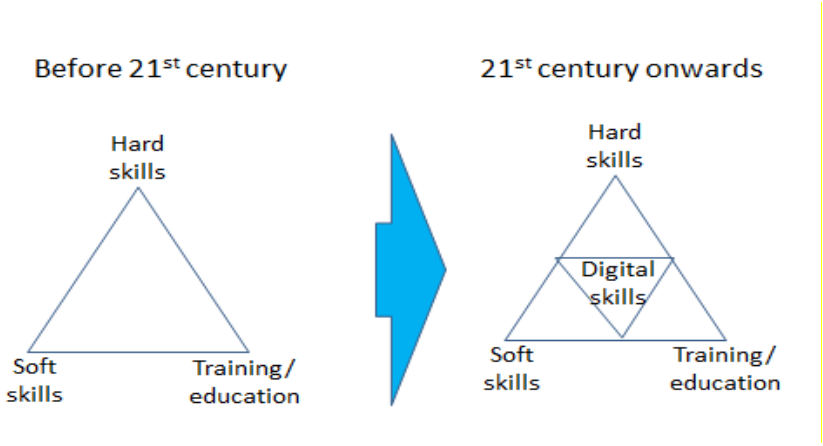
Discussion and conclusions

The findings section clearly demonstrates that skills are varied between companies. Some companies show a stronger focus on hard skills related to biotechnology than on soft skills. This can be considered an indication that soft skills are required without explicitly stressing them in job ads. Indeed, this skillset is often an issue of ongoing debate and people at all levels are aware of these skills Furthermore, we argue that high level of detail in job ads indicate a less open innovation culture within the company placing the ad. Presumably there is increasing and tight control of employees' activities in daily operations not only measured in output but also in actual behavior. It can be assumed that management is keen on monitoring employees and assessing them against the soft skills announced in the job ads during the actual work of employees. Therefore, we argue the less specific and dedicated soft skills are announced the more likely these skills are expected a 'MUST HAVE WITHOUT SAYING' by employers therefore little or no related monitoring and control takes place. Accordingly, we argue that applicants can read major aspects of companies innovation culture between the lines in the job ads, namely in section relevant to soft skills.

Overall the analysis found that the skillsets have changed. While during 20th century

hard skill, soft skills and training / education were mostly the only elements in the skills set the new century brought digital kills in addition (fig. 3).

Fig. 3. Changing composition of skillsets



Digital skills form a set of skills including the basic IT skills, e.g. IT literacy but also including IT-related soft skills, e.g. communication and presentation skills in the digital arena. Digital skills overlap partially with hard skills, soft skills and training / education, e.g. in other words digital skills can be viewed as communication skills which differ from the usual communication skills because in the digital area communication is stored and usually shared and put further whereas traditional communications is featured by a one-time communication event which is hardly codified and accessible to others. Therefore, individuals need to develop skills which are different from the established routines to maneuver successfully in the digital environment taking into account potential opportunities and also threats arising from these communication possibilities. Moreover, the effect described is not only relevant for communication but covers the full spectrum of information disclosure and information retrieval which makes information processing even more complex given the amount, validity and accurateness an speed of availability. Still these requirements are not fully codified and specified in the job ads of all countries analyzed which is why we assume that these skills are already understood as ‘MUST HAVE’ by companies. Very likely this is a phenomenon of the digital age and the digital natives respectively.

The findings also disclose a mismatch between job ads and the intended skills articulated in the interviews. What companies articulate is in many cases not found in the job ads for several reasons. First, companies are inclined to demonstrate an innovation friendly company culture which they try to communicate also in job ads. These ads are aimed at attracting the best talent naturally which is why soft skills are stressed in the ads. However, highly skilled talent is likely to pay less attention to these skills which they frequently assume to possess in any case. Therefore, a sophisticated description of soft skills in the ads carries the potential threat that talent becomes skeptical about the company. Second, highly skilled labor tend to have certain experience in the job market and has its own perception of the organization placing the ad which stems from communication in the community, previous experience or social media alike sources. Hence, sophisticated and detailed descriptions can hardly reflect the experiences and opinions collected by potential applicants. Thirdly, organizations are tempted to using job ads also for marketing their innovation potential to a broader audience by stressing the soft skills of talent they search. In this respect job ads also form one element of the overall marketing mix. However, it appears that marketing for human resources purposes is less developed than other marketing channels and instruments. Especially for attracting highly qualified and skilled talent such marketing activities require highly sophisticated approaches with special emphasis on psychological and related features.

Summing up, the work shows that skills and competencies form a strong element of

organizations' innovation culture. Organization's attitudes towards innovation are often nicely written in mission statements and other related strategy documents but how this culture is lived is usually very different. Therefore, attracting talent by means of stressing soft skills in job ads is assumed one indication of the actual company culture. Highly skilled labor is expected to understand the real innovation climate between the lines of job ads and soft skills especially. Let alone the ratio between hard skills and soft skills provides first indication what the main purpose of the job ad is. Skilled labor will feel well qualified for meeting ambitious hard skills related expectations therefore paying more attention to how expectations towards soft skills are expressed and communicated by means of organizational innovation climate.

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