



Ukraine: Higher Education Reforms and Dynamics of the Institutional Landscape

Nataliya L. Rumyantseva and Olena I. Logvynenko

INTRODUCTION

The developmental trajectory of the HE system in Ukraine has mirrored the large-scale transformations that have been taking place in the country since the collapse of the Soviet Union. Rapid change in the socioeconomic and political environments and dramatic demographic changes as well as vicissitudes in foreign relations have all formed the wider context in which the HE system has been evolving.

This chapter views the changes in the HE landscape through the lens of horizontal and vertical diversification and organisational interrelationships (Teichler 1988). Ukraine's HE followed a trajectory that is both similar and different to developments in other post-Soviet states (Huisman et al. 2007, 565), facing a shared communist past, bringing back to life pre-Soviet institutions and achievements and looking for the ways forward.

N. L. Rumyantseva (✉)

Business School University of Greenwich, London, UK

O. I. Logvynenko

National University of Life and Environmental Sciences, Kyiv, Ukraine

© The Author(s) 2018

J. Huisman et al. (eds.), *25 Years of Transformations of Higher Education Systems in Post-Soviet Countries*, Palgrave Studies in Global Higher Education, https://doi.org/10.1007/978-3-319-52980-6_16

We will review how horizontal institutional differentiation has been jumpstarted with the introduction of private universities and other structural changes in the system. We will also discuss changes in the vertical differentiation amongst institutions of HE based on their status and ranking system. The interrelationships amongst old and new universities have inevitably shifted towards being more competitive, which presents not only a new practice for the system but also an additional challenge in the face of negative demographic trends.

BRIEF HISTORICAL OVERVIEW OF THE PRE-SOVIET HE SYSTEM IN UKRAINE¹

The first HEIs in Ukraine appeared in the West of the country and, in Kyiv, the capital of Kyivan Rus. Towards the end of the sixteenth century, Western Ukraine was experiencing religious and national identity struggles whilst seeking to position itself between the influence of Orthodox Christian Russia and Roman Catholic Poland and Austria. The Ostrozska Academy, established in 1576, was the first HEI established in the territory that is now Ukraine. The Academy was closed in 1636. In 1632 Petro Mohyla, Metropolitan of Kyiv, founded a later well-known Kyiv-Mohyla Academy whose main purpose at the time was to ‘benefit the Orthodox Rus’ religious and ethnic communities’ (Yershova and Gordiichuk 2013, 474). The Academy became an influential centre of innovation and research and served as a model for universities in Eastern territories established in the nineteenth century (Bunina 2013). In 1817, however, the Academy closed down soon after Russian Empress Catherine II withdrew her financial support.

In the mediaeval city of Lviv, the Roman Catholic Jesuits order actively pursued the approval of the Polish King John II Casimir who eventually granted permission to establish the University of Lviv in 1661. The University facilitated the development of this region (Bunina 2013) and produced several graduates of national impact. Over a 100 years later, another university in the western part of the country was opened in 1875 in the city of Chernivtsi. Although the University teaching was originally delivered in German, it gradually became a multicultural and multi-lingual institution.

In the modern Eastern Ukrainian territories, the first HEIs appeared at the beginning of the nineteenth century. These HEIs were established in

territories that at that time were under the jurisdiction of the Russian Empire. Hence, they reflected different principles and traditions. Osipian (2008) describes the Russian tradition in HE as one of ‘weak university self-governance’, compensated by ‘strong state control’. The first university in these territories was opened in the city of Kharkiv in 1805. Other national universities were open in Kyiv (1834) and Odessa (1865).

Institutions established under Western European influence differed in many ways from their Eastern counterparts in the underlying autonomy models that underpinned institutional relationships with the corresponding governments. In the West, the impact of religion on HEIs was given considerable importance by the state (whether Polish or Austrian) and often resulted in clashes with the religious beliefs of the Ukrainian population. In the East, issues concerning institutional autonomy were the key source of tension in university-government relations.

A parallel trend of systematic development of teacher training institutions started in the 1860–1870s. This development introduced the first elements of differentiation into the HE system as these institutions combined elements of vocational training with advanced studies and attracted a specific student population interested in the teaching career. Initially, not all of them were HEIs. The first teacher training HEI opened in Gluhiv in 1874 (Bunina 2013) putting a start to what is now a robust net of pedagogical universities.

By the beginning of the twentieth century, student numbers in higher education had doubled by comparison to the late 1800s, although access for poorer working class and peasant youth was still severely restricted (Bunina 2013). Immediately prior to 1917, the Ukrainian HE system amounted to 27 institutions that educated more than 35,000 students (Kurbatov 2014). During the brief period of Ukraine’s independence and the Civil War of 1917–1920, additional HEIs were opened in the capital, including the Academy of Pedagogy, as well as in Kamyanytsya-Podilskyi in the West and an early form of Tavriya University in the Crimea. By the time most of the current Ukraine’s territory became part of the USSR in 1939, Ukraine had 129 HEIs. In 1941, Ukraine had 162 HEIs and around 130,000 students. Table 16.1 presents a simple typology of the HEIs by extent and type of specialisation. At this point, Ukraine had six comprehensive universities. Technical and industrial institutions were leading the way along with their pedagogical counterparts, reflective of the needs of the economy and the high emphasis placed on access to secondary education.

Table 16.1 Typology of HEIs by specialisation in 1941

| <i>Type of HEI</i> | <i>Number of HEIs</i> |
|--------------------------------------|-----------------------|
| Comprehensive universities | 6 |
| Industrial/technical institutes | 40 |
| Agricultural institutes | 19 |
| Economics institutes | 6 |
| Pedagogical institutes | 69 |
| Medical institutes | 15 |
| Art, music and theatrical institutes | 7 |
| Total | 162 |

Source: Buhalo (1945)

UKRAINIAN HIGHER EDUCATION SYSTEM BETWEEN 1940 AND 1990

Not unlike other post-Soviet states, the Soviet Ukrainian HE system was designed and developed to supply the manpower needs of the economy. In a highly centralised social system, HE was controlled and coordinated in relation to the industry and economic needs of the USSR. The military needs during the war and then the post-war arms race mirrored themselves in the growing numbers of engineering and other technical specialisations. Centralised control and manpower planning enabled institutional inter-relationships that were primarily based on the principles of complementarity rather than competition. Ukrainian HEIs during the Soviet period were producing graduates for the needs of other Soviet republics as well as Ukraine itself. Two institutions, in particular, were noteworthy for their all-USSR student body: the Ivano-Frankivsk National Technical University of Oil and Gas and the Mykolayiv Shipbuilding Institute.

Disciplinary orientation and geographical location in part determined HEIs' role in the overall system and national economy. In addition, student mobility was not very high but policy measures were implemented over time to boost the HE participation rate for low-income applicants, especially from the countryside. Higher education was free of charge and all students were admitted on a competitive basis. Students also received a modest stipend to cover living expenses. This gradually boosted student mobility.

After World War II and Stalin's death in 1953, Khrushchev's government undertook a reform of the HE system. In the 1950s–1960s, the HE system was slightly downsized, with some institutions closed or merged, leaving 135 HEIs instead of 160. The student numbers, however, doubled in comparison with the pre-war period. Diversity in the form of delivery grew, including the delivery by correspondence (*zaochyi fakultet*), further opening opportunities for older individuals already in the labour force.

Vertical institutional differentiation had become particularly clear by this time. Comprehensive universities enjoyed higher status, a wider range of disciplines and more privileges, including opportunities to engage in research, whilst specialised institutes focused primarily on teaching within their chosen fields. Polytechnics, however, received additional support and funding from the government at this time, fuelled by the need to rebuild the country (USSR) after the war, whilst maintaining its technologically competitive status in the international political arena. Many of these polytechnics grew into well-recognised and prestigious institutions of the time. Table 16.2 presents the state of the system in 1988, shortly before the collapse of the Soviet Union. Horizontal diversity is evident in the different types of specialisation within universities. Technical HEIs attracted the largest number of students at the time, followed by pedagogical HEIs, suggesting a possible element of vertical differentiation based on their importance in the overall social system.

Table 16.2 Typology of HEIs by type of specialisation in 1988

| <i>Type HEI</i> | <i>Number of HEIs</i> | <i>Number of students</i> |
|---------------------------------------|-----------------------|---------------------------|
| Comprehensive universities | 10 | 98,734 |
| Pedagogy and education | 42 | 257,014 |
| Technical (industry and construction) | 40 | 318,181 |
| Transport and communication | 10 | 56,284 |
| Agriculture | 17 | 90,372 |
| Economics and law | 10 | 68,964 |
| Medicine and sport | 18 | 56,591 |
| Art and cinema | 9 | 6,572 |
| Total | 156 | 952,712 |

Source: Goskomstat (1989)

CHANGES IN THE HE SYSTEM SINCE UKRAINE'S INDEPENDENCE: POLICY, PRACTICE AND AGENCY

With the onset of independence, Ukraine's HE system had 156 HEIs at the beginning of the 1991/1992 academic year. The system was then about to enter a long and turbulent period of reforms with varying levels of success in implementation.

Initially, the only active agency in the reform process belonged almost exclusively to the President, the Parliament and the Cabinet of Ministers. Fimyar (2010), in her analysis of policy rationales in HE, argues that the primary policy documents reveal that the sources of all policy documents were Presidential Decrees, whilst Educational Laws, directives of the Cabinet of Ministers and Ministry of Education laws and directives were derivatives of the latter. It is in part understandable why the president of a highly centralised country so inexperienced in self-governance would be reluctant to delegate important decisions, but such high levels of centralisation in policy sources excluded important stakeholders from having a voice for at least two decades, having an inevitable impact both on the institutional diversity, institutional interrelationships and the quality and relevance of higher education to the country's economy and social development. The reform processes have been underpinned by three key rationales: *nation and state building, comparison and critique, and finally catch-up Europeanisation* (Fimyar 2010). The following three sub-sections explain the nature of each rationale in more detail.

Nation and State Building

The *nation and state building* rationale is grounded in the concerns of separation from the Soviet past, establishing a differentiated system, reviving pre-Soviet traditions and history as well as pursuing active ukrainianisation of the educational process to ensure that the historically vulnerable Ukrainian language (Janmaat 2008) continues to develop and shape the national identity of the Ukrainian people. The proportion of university students instructed in Ukrainian in the 1995/1996 academic year was 51%. In 2002/2003 this figure grew to 78%, with Western (99%) and Central Ukraine (approximately 96%) taking the lead. Even in the traditionally Russian-speaking East and South, these figures grew from 23% to 58.9% and from 26.9% to 55.5%, respectively (Ministry of Statistics 2003). The use of language presents a more complex picture, however, if we

consider formal and informal use, the use of *Surzhyk* (a mixture of Russian and Ukrainian) and the ideological dimensions of linguistic diversity (Bilaniuk and Melnyk 2008). The government's language policies sparked much controversy and, some believe, ate up valuable time and resources, leaving other goals disadvantaged (Byron 2001). Others argue that ethno-linguistic self-identification is crucial for second wave Wilsonian states, which derive their legitimacy for independence primarily through ethnic and linguistic markers (Janmaat 2008). Regardless of how one evaluates these changes, they undoubtedly became a source of horizontal institutional differentiation, with Western and Central Ukrainian HEIs being more ukrainianised than their Eastern and Southern counterparts. In addition to language as a marker of ethnic identity, shared Ukrainian history was revived via symbolic (but also very practical) rebirth out of mediaeval ruins of two HEIs: the Kyiv-Mohyla Academy in 1991 and the Ostrozska Academy in 1994. Several new HEIs were opened to supply qualified staff for the newly created state organs of the independent Ukraine: the University of Customs and Finance (1996), the National Academy of Internal Security of Ukraine (1992) and the University of the State Fiscal Service (1999).

In addition to the revival of language and history, the Law of Ukraine on Education (1991) and the Law on Higher Education (2002) made the statement that Ukraine's HE system was to be structured differently and to some extent mirror the growing liberalisation of the economy and of property rights. The most radical change at this stage was the introduction of the private or non-state HEIs. This set the precedent for an alternative private HE system. By 2013, the proportion of private HEIs mounted to 21% of all the HEIs in the system. According to UkrStat, Ukraine had 162 private institutions in the 2015/2016 academic year, comprising around 130,000 students (State Office of Statistics of Ukraine 2016). New institutions have only loosely been regulated and were largely left to their own devices to find their way in the market. The impact of private HE providers on the quality of education in the system remains unclear. They appear to be a lot less competitive than traditional public institutions but tap into the same intellectual potential of the academic staff thus, according to some reports in the Ukrainian press, diluting the system. A more systematic approach, however, is needed to assess how this form of institutional differentiation is influencing the quality and relevance of HE in the country. From the students' perspective, the division between private and public higher education becomes less clear as more and more students across

all institutional types pay the cost of their studies out of their own pocket. On the whole, 52.3% of all students, across all types of institutions, were paying tuition fees in the 2014/2015 academic year, whilst 46.1% were funded from the state budget, with a small minority being funded from city budgets (0.9%) and from the budgets of private companies (0.7%) (State Office of Statistics of Ukraine 2015).

The second prominent feature of systemic changes in the onset of independence has been the merging of parts of the vocational education system with higher education. Secondary specialised educational institutions (*uchilischa* and *tehnikumy*) were reclassified as HEIs of I and II levels of accreditation, and more established HEIs as level III and level IV. By changing the status of these institutions, the Law on Higher Education (2002) increased the institutional diversity of the HE system. HEIs at different levels served different functions and attracted different types of students (horizontal differentiation) but also enjoyed different levels of prestige and status (vertical differentiation) both with the government and students. This becomes particularly obvious when we consider that the number of HEIs of levels I and II exceeded that of the III and IV levels throughout the period of independence (Fig. 16.1), though the latter were leading in student numbers by 1995 (Fig. 16.2).

In addition to increased institutional differentiations and choice, the new structure incorporated a more diverse set of degrees, starting with junior specialist granted in HEIs of levels I and II and the new-for-the-system Bachelor's degrees, which left graduates qualified to enter Master's programmes, alongside specialist degrees inherited from the Soviet system which in principle enabled graduates to enter doctoral-level studies. Doctoral-level degrees were left unchanged from the Candidate of Science and Doctor of Science until later reforms (specifically the Law on Higher Education passed in 2014). At this stage, the new structure thus combined elements of Western degrees with the Soviet heritage. The second Law on Higher Education (2014) has left the status of level I and II institutions undefined, although the practice of students' direct entry from college into the second year of university continues, which implies that level I and II institutions remain a part of the HE system. The Soviet doctoral-level degrees were replaced at this stage with the more familiar to the Western reader Doctor of Philosophy (PhD). The licence to grant this higher-level degree serves as an additional source of institutional differentiation, with the academies and the universities having the exclusive right to bestow it.

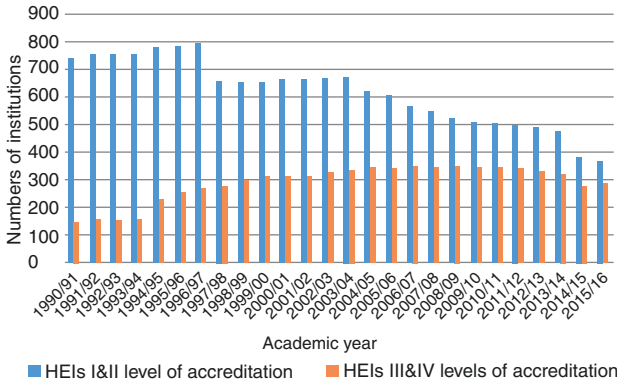


Fig. 16.1 Numbers of HEIs by levels of accreditation, 1990–2015 (The data for 2014–2015 and 2015–2016 are not fully comparable to data from previous years as they do not take into account institutions that remained in the occupied territories and the zone of military conflict in Donetsk, Lugansk and Crimea. Source: State Office of Statistics of Ukraine (2016))

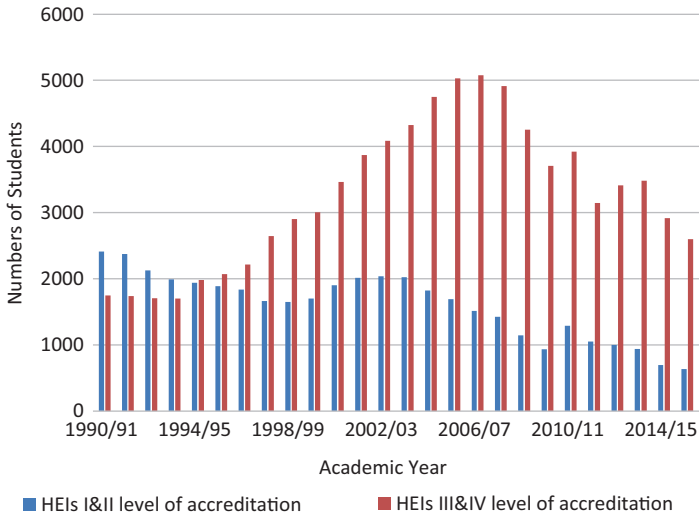


Fig. 16.2 Numbers of students in HEIs by levels of accreditation, 1990–2015 (The data for 2014–2015 and 2015–2016 are not fully comparable to data from previous years as they do not take into account institutions that remained in the occupied territories and the zone of military conflict in Donetsk, Lugansk and Crimea. Source: State Office of Statistics of Ukraine (2016))

Whilst the number of HEIs continued to grow along with the student numbers, the demographic situation in Ukraine took on a negative turn from the early 1990s onwards. Whilst 1990 saw 657,000 children born, in 2001 when the birth rate hit its lowest, there were only 376,000 births. This trend has been accompanied by high emigration and brain drain rates. The first decline in student numbers can be seen in 2008 for level III–IV institutions, which corresponds to the 1991 born cohort. At the same time, the number of HEIs of III–IV accreditation levels increased from 156 in 1991/1992 to 351 in 2006/2007, a 125% increase.

Although the negative demographic trend has been partly offset by growing participation rates and increasing popularity of second HE degrees amongst already employed university graduates, on the whole, these trends taken together represented a time bomb for the HE system. Unfortunately, very few Ukrainian policy makers and university managers chose to acknowledge them with any strategically developed response. Hence, the inevitable oversupply of HEIs posed a serious problem and the question of mergers has arisen for the recent and the current Ministers of Education, Serhiy Kvit and Liliya Grynevych.

Comparison and Critique

The second policy rationale—*comparison and critique*, or more precisely *self-critique*—has generated discourse around the desired states of decentralisation, quality control, modernisation, democratisation, internationalisation and equal access, often noticed by Western observers as positive developments (Johnston and Bain 2002; Silova 2009). Such aspirational goals on the one hand and acute awareness on the other of the real state of affairs—which is seen as lacking in all these qualities by the Ukrainians themselves—are what generates most of the self-critique and the notion of a persistent educational crisis. Specific facets of the crisis are described in Presidential (1995) and Parliamentary Decrees (2002) and admit to the low status of the academic profession, unacceptably low salaries, the low and decreasing level of prestige of higher education, limited diversity in the forms of ownership and declining interdisciplinary links (Fimyar 2008). This policy discourse identifies the reasons for the crisis highlighted in the Law on Education of 1991 (Fimyar 2008) as significant reduction in educational spending, lack of implementation of policies on social protection of teachers, the legacy of the Soviet system of education (specifically politicisation and bureaucratisation) and, at the same time, nostalgic

whining about the weakness of the modern state's control over quality of education. A large step from a highly centralised system to a more democratic and self-governing one is perhaps not possible without some ambivalence and hesitation, which comes across in the early educational discourse. What is troublesome, however, is that an 'impersonal' critique is fostered, 'limited to critical evaluation of the processes but not the actors behind these processes; the identification of which is crucial for understanding and overcoming the crisis' (Fimyar 2010, 80).

Interestingly, similar types of issues pertaining to the notion of crisis in HE were raised by academic staff and administrators in the case study by Shaw et al. (2013), conducted a decade after these weaknesses were originally noted in official documents. The study additionally documented the complaints of university administrators on low levels of autonomy in terms of financial self-management and of academic staff in terms of the structure and content of degree programmes. Levels of autonomy are not identical across the system, however, serving as a source of vertical institutional differentiation. Currently, three state HEIs have the status of autonomous/self-managed universities with greater powers over their budgets, academic curriculum and capacity to forge external links (Table 16.3). There is also a plethora of private institutions that enjoy relatively high levels of autonomy from the government in terms of their own income generation and spending, and to a certain extent over curriculum planning and implementation.

Respondents in the case study conducted by Shaw et al. (2013) were drawn from a HEI that is less autonomous by formal criteria. Unsurprisingly, the accuracy of understanding of the status quo evident in the interviews was accompanied by an acute awareness of the informers' own helplessness with regard to reality, with only occasional sparks of optimism and sense of agency from selected top-level administration or very experienced academic staff.

The Law on Higher Education (2014) has made some notable steps in the direction of creating an explicit sense of agency in the system by introducing actors apart from the government and charging them with specific responsibilities. Specifically, in creating provisions for a Quality Assurance Agency, which is expected to function as an arms-length body, similarly to its UK namesake, the Law makes an effort to delegate important monitoring functions away from the Ministry. The Agency has not started functioning at the time of this writing, however, which makes it impossible to comment on the actual realities of its work and division of responsibilities.

Table 16.3 Typology of higher education institutions in Ukraine in 2016

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction*</i> |
|--|---|-----------------|--|----------------------------|---------------------------------|-------------------------------|--|-----------------------------------|
| Flagship universities | Kyiv National University of Taras Shevchenko; Kharkiv National University of Vasyl Karazin; National University 'Ostrog Academy' | 3 | Kyiv, Kharkiv, Ostrog | Multidisciplinary | High | High | Autonomous/self-managed/state and own budget | Ministry of Education and Science |
| Nationwide HEIs | | | | | | | | |
| National comprehensive universities | Ivan Franko National University of Lviv; National University of Kyiv-Mohyla Academy; Donetsk National University; Taras Shevchenko National University of Luhansk; Lesya Ukrainka East European National University; Khmelnytskyi National University | 19 | Lviv, Kyiv, Odessa, Chernivtsi, Dnipro, Zakarpattia, Vinnytsia, Luhansk, Khmelnytskyi, Poltava, Zaporizhia, Volyn, Mykolaiv, Cherkasy, Ivano-Frankivsk | Multidisciplinary | High but above average for HEIs | Medium High | State | Ministry of Education and Science |

(continued)

Table 16.3 (continued)

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction^a</i> |
|---------------------------------|---|-----------------|--|-------------------------------------|-----------------------------------|-------------------------------|--|---|
| Academies/ state | Bogdan Khmelnytskyi's National Academy of State Border Service; Academy of Internal Troops of Ukraine; Ukrainian Academy of Internal Affairs; National Metallurgical Academy of Ukraine | 10 | Khmelnytskyi, Kharkiv, Kyiv, Dnipro | Specialised Sectoral speciality | High to medium | High | State | Ministry of Education and Science |
| Academies/ non-state | National Academy of Management | 1 | Kyiv | Sectoral speciality | Medium | Medium | Private | Ministry of Education and Science |
| Technical HEIs/state | Kharkiv Petro Vasylenko's National Technical University of Agriculture; Lviv National Polytechnic; Kharkiv National Polytechnic; Kyiv National Polytechnic; Donetsk National Polytechnic; Central Ukrainian National Polytechnic; Ivano-Frankivsk National Technical University of Oil and Gas; Donbas State Technical University | 15 | Nationwide specialised Kharkiv, Lviv, Kyiv, Donetsk, Kirovohrad, Kherson, Volyn, Poltava, Zaporizhia, Ternopil, Vinnytsia | Nationwide specialised Technical | Medium but above average for HEIs | High | State | Ministry of Education and Science |

(continued)

Table 16.3 (continued)

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction</i> |
|---|---|-----------------|--|----------------------------|--------------------------|-------------------------------|--|---|
| Sectoral HEIs/state | National University of Pharmacy; 65 Odessa National Economics University; Sumy National Agrarian University; Tugan-Baranovsky's Donetsk National University of Economics and Trade; National University "Yaroslav the Wise Law Academy of Ukraine"; National Aviation University; National Pedagogical Dragomanov University; Ukrainian National Forestry University; South Ukrainian National Pedagogical University; Admiral Makarov National University of Shipbuilding; Tchaikovsky National Music Academy of Ukraine; Banking University; Ukrainian Academy of Banking of the National Bank of Ukraine ^c | | Kharkiv, Kyiv, Mykolajiv, Donetsk, Lviv, Vinnytsia, Zhytomyr, Dnipro, Ternopil, Ivano-Frankivsk, Volyn, Sumy | Sectoral speciality | Medium | High to medium | State | Ministry of Education as well as a corresponding Sectoral Ministry (e.g. Ministry of Healthcare for Medical HEIs) |
| Total nationwide and flagship HEIs | | 113 | | | | | | |

(continued)

Table 16.3 (continued)

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction^a</i> |
|--|---|-----------------|---|----------------------------|--------------------------|-------------------------------|--|--|
| | Regional HEIs | | | | | | | |
| | Comprehensive | | | | | | | |
| Regional comprehensive universities | Sumy State University; Kherson State University; Zhytomyr State University; Nizhyn Gogol State University; Mariupil State University; Mukachevo State University | 6 | Sumy, Kherson, Zhytomyr, Chernihiv, Mariupil, Zakarpattya | Multidisciplinary | Medium to low | Medium | State | Ministry of Education |
| Regional comprehensive universities/non-state | Ukrainian Catholic University; Alfred Nobel University; European University; Luts'k University Institute of Human Development "Ukraine"; Classic Private University; International Solomon University; Bukovyna University | 11 | Dnipro, Lviv, Kyiv, Volyn, Zaporizhia, Odessa, Chernivtsi | Multidisciplinary | Medium to low | Medium | Non-state | Ministry of Education |
| | Specialised | | | | | | | |
| Academies/state | Dnipropetrivsk State Medical Academy; Donbas State Machine-Building Academy; Academy of Municipal Management; Ukrainian Engineering Pedagogics Academy; Odessa State Academy of Civil Engineering and Architecture; Prydniprovsk State Academy of Civil Engineering and Architecture; Military Academy; Kirovograd Flight Academy | 29 | Dnipropetrivsk, Donetsk, Kyiv, Kharkiv, Odessa, Poltava, Zaporizhia, Lviv, Kherson, Kirovograd, Poltava, Dnipro | Sectoral speciality | Medium | Medium | State | Ministry of Education as well as a corresponding Sectoral Ministry (e.g. Ministry of Healthcare for Medical Academies) |

(continued)

Table 16.3 (continued)

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction</i> |
|--|--|-----------------|--|----------------------------|--------------------------|-------------------------------|--|--|
| Academics/ non-state | Lawyer Academy of Ukraine; Interregional Academy of Personnel Management; Academy of Work, Social Relations and Tourism | 3 | Kyiv | Sectoral speciality | Medium to low | Medium | Non-state | Ministry of Education as well as a corresponding Sectoral Ministry (e.g. Ministry of Healthcare for Medical Academics) |
| Regional HEIs Specialised | | | | | | | | |
| Academics/ municipal | Kremenets Regional Humanitarian Pedagogical Academy; Vinnytsia Academy of Continuous Education; Kharkiv Humanitarian Pedagogical Academy of Regional Council | 3 | Kharkiv, Ternopil, Vinnytsia | Sectoral speciality | Low | Low | Municipal | Ministry of Education |
| Technical HEIs/state | Podilsky Technical University of Agrarian Science; Mykolaiv Polytechnic; Pryazovskiyi State Technical University; Dneprodzerzhinsk State Technical University; Zhytomyr State Technological University International Science Technical University of Yuri Bugay; Mykolaiv Polytechnic Institute | 5 | Marupil, Khmelnitskyi, Donetsk, Mykolaiv, Zhytomyr | Technical | Medium to low | Medium | State | Ministry of Education |
| Technical HEIs/ non-state | | 2 | Kyiv, Mykolaiv | | | | | |

(continued)

Table 16.3 (continued)

| Type | Examples of HEIs | Quantity | City or region | Educational profile | Research activity | International activity | Form of governance/form of ownership/ source of budget | Ministerial jurisdiction ^a |
|--------------------------------|---|-----------------|---|--|-------------------|------------------------|---|---------------------------------------|
| Sectoral HEIs/state | Bukovinian State Medical University; State University of Telecommunications; Ternopil State Medical University; Zaporizhia State Medical University; Podilsky Technical University of Agrarian Science; IZmail State University of Humanities; Tavria State Agrotechnological University; Kosiv Institute of Applied and Decorative Art | 87 | Chernivsi, Kyiv, Ternopil, Zaporizhia, Dnipro, Ivano-Frankivsk, Khmelnytskyi, Kherson, Odessa, Kharkiv, Poltava, Dnipro, Lviv, Chernihiv, Luhansk, Zaporizhia, Zhytomyr, Kropyvnytskyi, Donetsk | Sectoral speciality | Medium to low | Medium | Private/cooperative/joint ownership | Ministry of Education |
| Sectoral HEIs/non-state | Kyiv Medical University of Ukrainian Academy of Untraditional Medicine; International University of Business and Law; International University of Finance; Kyiv University of Law; KROK University; Hungarian Institute of Ferenc Rákóczi II; Kyiv School of Economics; Tourism Institute of Federation of Trade Unions of Ukraine ^d | 40 ^e | Kyiv, Kherson, Ternopil, Khmelnytskyi, Zakarpattia, Rivne, Odessa, Kropyvnytskyi, Lviv, Volyn, Kharkiv, Dnipro | Regional specialised Sectoral speciality | Low | Medium | Private/cooperative/joint ownership | Ministry of Education |

(continued)

Table 16.3 (continued)

| <i>Type</i> | <i>Examples of HEIs</i> | <i>Quantity</i> | <i>City or region</i> | <i>Educational profile</i> | <i>Research activity</i> | <i>International activity</i> | <i>Form of governance/form of ownership/source of budget</i> | <i>Ministerial jurisdiction</i> |
|--|---|-----------------|------------------------|--------------------------------------|--------------------------|-------------------------------|--|---------------------------------|
| Sectoral HEIs/municipal | Zhytomyr Institute of Nursing; Institute of business "Strategy"; Kyiv Cooperative Institute of Business and Law | 3 | Zhytomyr; Dnipro, Kyiv | Sectoral speciality | Low | Low | Municipal | Ministry of Education |
| Total regional | | 189 | | | | | | |
| Other types of IHE (branches of overseas or joint HEIs) | Wisconsin International University in Ukraine; Central European University (Ukrainian-Polish) | 2 | Kyiv | Specialised (economics and business) | Low | High | Private | Ministry of Education |
| Total HEIs | | 304 | | | | | | |

^aAccording to Order No. 1191-p of the Cabinet of Ministers of Ukraine (2011), all HEIs in Ukraine will be transferred over time to the jurisdiction of the MoE which licences their operations. However, in practice, sectoral HEIs have to coordinate and agree their curriculum with sectoral Ministries before seeking approval from the MoE.

^bThese and several other institutions from the Donetsk and Luhansk Regions have been evacuated from the region of military operations to other areas of Ukraine. In some cases, parallel versions of these institutions continue to operate in their original locations but their formal identification with Ukraine (through licencing) is not recognised by the Ukrainian side.

^cThese HEIs come under the jurisdiction of the National Bank of Ukraine.

^dThis institution is also under the jurisdiction of the Federation of Trade Unions of Ukraine.

^eThe total number of non-state institutions in this typology amounts to 59, which is considerably fewer than the 169 reported to exist in Ukraine by the State Office of Statistics of Ukraine (2016).

Another thought-provoking phenomenon apparent in the most recent legislative changes is a tendency for policy makers to blame academic staff for poor implementation of the changes and a corresponding resentment of academic staff towards the government for not creating sufficient legal and system-wide provisions to enable the implementation processes. For instance, although universities are allowed in principle to hold their own bank accounts, the legal and procedural details of this change have not yet been implemented, making it impossible for universities to take advantage of this opportunity. These conversations appear to be happening at cross purposes and much gets lost in translation (e.g. Fedorchenko 2016; National Aviation University 2015). On the positive side, there is evidence of dialogue between the power and the people, which had previously been suppressed.

In addition to the most obvious stakeholders in HE, government, academic staff and university administrators who find themselves in strenuous and difficult relationships with one another, the discourse of comparison and critique also pervades the minds of students, many of whom prefer to study abroad and often fail to return to Ukraine after completion of their studies. This creates a problem known as ‘brain drain’ or ‘brain waste’ (Semiv and Hvozdoych 2012). At the time of writing, this exit appears to be the primary if not the only mechanism accessible to students to communicate their views on the state of the national HE system.

Employers are equally dissatisfied. According to the World Economic Forum Global Competitiveness Report (2011), despite relatively comprehensive higher education coverage (8th place out of 142 countries), Ukraine takes the 51st place in terms of perceived quality. According to the survey, employers complain about the lack of important employability skills, including critical analysis, emotional, technical and even basic mathematical skills. Despite this documented dissatisfaction, the Federation of Employers in Ukraine’s involvement in higher education reforms remains minimal. In stark opposition are the views of rectors on the quality and state of higher education in the country. According to a survey conducted by the Ukrainian Democratic Initiatives Foundation, most rectors report high quality of education in their institutions and raise concerns around poor funding and disinterested students (Democratic Initiatives Foundation 2015). One may conclude that the views and opinions of various stakeholders on the state of quality of the HE system in Ukraine are akin to those of the fabled blind men touching an elephant, though most agree on the notion of crisis. Responsibility for the crisis, however, is

pushed around like a football on a playing field. On the whole, the *comparison and critique* discourse lacks a clear sense of agency and, as a result, has not had any significant impact on the structure or extent of differentiation of the HE system. The Soviet legacy remains largely untouched.

Catch-Up Europeanisation

If the HE system is seen as being in crisis, Europeanisation or rather *catch-up Europeanisation*, the third policy rationale identified by Fimyar (2010), is seen as the strategy by which to emerge from crisis. Based on extensive study of policy documents pertinent to higher education reform, Fimyar (2020, 81) concludes that this narrative is widespread and all-pervading, seeking to reach ‘every subject, organisation, as well as the system of education as a whole, to align existing Ukrainian norms, capacities, and ethos with those in ‘Europe’ and the “world”’. The most obvious manner in which this narrative is manifested in practice is Ukraine’s joining the Bologna Process in 2005. Experiments with Bachelors’ degrees inspired by the Bologna Process started as early as the year 2000. More widely, this policy rationale pervades all strategies of moving from the ‘old’ system to the ‘new’, bridging the gap between the ‘ideal’ and the ‘real’, as well as all the tools and changes aimed at resolving the educational crisis described above. The practical implementations, however, are riddled with difficulties and often encounter insurmountable resistance from various actors in the system. In fact, resistance appears to be the most common way for various stakeholders to respond to changes implemented from above. A case study by Shaw et al. (2013) presents multiple examples of academics trapped by competing external pressures as well as the internal need for meaning derived from their work. These tensions lead to selective adaptation of the Bologna requirements. Clearly, the role of lower-level stakeholders should not be underestimated in the process of changes. Although the approach to the reforms has gradually become more democratic (as part of the catch-up Europeanisation narrative) as more and more information is shared with lower-level stakeholders and some consultations are taking place (e.g. with the Council of Rectors), the relationship between the government, institutions and academic staff within them appears to be pervaded with low levels of trust. This, in turn, causes difficulties in communication and panic amongst the lower levels as a response to changes, and possibly a hesitation to communicate more openly on the part of such strategic actors as the Ministry. Such tensions may be indicative

of more deeply seated problems described by Kovryga and Nickel (2006) as a cycle of false necessities in the reform processes in Ukraine, for which they partly blame excessive pressures for reform from the West and the very high speed of change.

Admittedly, Europeanisation has impacted different parts of the system to different degrees. Larger, national-level HEIs have had better access to student mobility programmes, staff professional development opportunities which often bring Western notions into the Ukrainian realities (e.g. empowerment) and joint degrees with overseas institutions. HEIs located in Kiev also tend to have an advantage due to their relatively better accessibility for foreign visitors. Smaller institutions located in smaller towns tend to have less contact with their EU counterparts, less funding to finance international conferences or institutional visits and, as a result, develop fewer international links. International links and academic staff with overseas backgrounds form an attractive and prestigious feature for students. Hence, to a certain extent, Europeanisation policies have contributed to the vertical diversification of the institutional landscape.

The Law on Higher Education (2014) and the Most Recent Changes in the Institutional Landscape

The recently adopted Law on Higher Education (2014) has a special significance in the process of HE reform in Ukraine and comes at a significant time in Ukrainian history, following the Revolution of Dignity and the assertive stance Ukraine adopted on national self-governance. As insufficient time has yet to pass from its adoption it would be unreasonable to expect fully fledged implementation at the time of writing. It is, however, important to note several aspects which weave in the above-mentioned changes, leading to already noticeable alterations in the institutional landscape.

First of all, there is an explicit effort to engage all the most immediate stakeholders of HE with the quality assurance process. The newly created Quality Assurance Agency is expected to draw on representatives of academic staff (excluding senior managers), employers and students. Secondly, rectors will once again be elected, with students' voices having a greater impact (15% in proportional representation) on the outcome than before, which democratises the system. The Ministry of Education will be obliged to appoint rectors who have been elected in this fashion, regardless of the Ministry's own views. This is a clear step towards supporting institutional

autonomy and self-governance. The Law abolishes the concept of levels of accreditation, which simplifies the typology of HEI and leaves four types of institutions: comprehensive universities, specialised institutes, academies and colleges. This change has not yet been fully implemented. Moreover, the Ministry of Education is planning to discontinue the direct financing of colleges, leaving them attached to the municipal budgets. Expert observers predict that this will cause colleges to merge with higher status HEIs, thus reducing their overall number. Given the extremely high number of level I and II colleges at the time of writing (over 1500) and the high likelihood of forthcoming comprehensive changes in this part of the system, the authors have chosen to present only level III and IV institutions in the most up to date typology of Ukrainian HEIs. Although this part of the overall system appears to be more stable than institutions with lower levels of accreditation, it is not completely shielded from changes. The recent Minister of Education Serhiy Kvit had tackled the rather high numbers of HEIs of III and IV levels of accreditation with plans and some actions to reduce their numbers via closures and mergers. For example, the Lugansk State Institute of Housing and Utilities and Building was closed in 2015 (Cabinet of Ministers 2015). Moreover, the Accreditation Commission that functions under the jurisdiction of the Ministry of Education announced a list of 60 HEIs in 2015 that may be closed following quality control revisions of their curriculum and study programmes. The process is on-going and the full impact on the institutional landscape remains to be seen.

At the time of writing, the Ukrainian HE system amounted to around 300 HEIs of levels III and IV of accreditation with clear elements of vertical and horizontal differentiation. Flagship institutions present the most successful ones, both in terms of the status granted by the government (highly autonomous with their own budgets) as well as consolidated independent rankings (a market element of the system) (Osvita.ua 2016). These institutions, however, occupy very low positions in the Times Higher Education Rankings of HEIs worldwide (Times Higher Education Rankings 2016). The overall picture suggests that the number of technical HEIs has been considerably reduced in comparison with 1988 (Table 16.2), with only 22 institutions remaining, 20 of which are state owned. The total number of comprehensive universities amounts to 28 state (22 national and 6 regional) and 11 non-state establishments, whereas specialised institutions are much more numerous, with 181 state-owned, 44 non-state-owned and 6 supported by municipal budgets.

CONCLUSIONS

Ukrainian HE developments inevitably testify to the path dependency and reliance on the post-Soviet legacy as the point of departure—either by seeking to overcome it or to incorporate it into the new realities. Similarly, the fascination with EU developments and the zeal to modernise the system represent an equally strong driver that impels Ukraine to implement changes, assimilate Bologna alterations and seek developmental inspiration from the West. The black box in the middle between these two drivers represents authentic and unique Ukrainian concerns, aspirations and visions of how and why the HE system has to function for the distinctive needs of Ukrainian economy and society. Like most other post-Soviet but also European nations, Ukraine is seeking to reshape its system of Higher Education to fit into the globalised world, whilst ensuring the country's interests are sufficiently protected.

The chaotic 1990s released a great amount of creative resources, which up until then had been securely hidden under Soviet regulatory pressure. This, in turn, unleashed the process of growth and institutional diversification along with the increased participation rates, resulting in a somewhat hectic and overgrown higher education system. The diversity of institutional types and horizontal differentiation in the system has also increased with the proliferation of non-state and municipal universities, academies and institutes. The number of technical institutions has decreased in comparison with the late Soviet period, whereas institutions specialising in the social sciences have outperformed the needs of the economy to a certain extent. On the other hand, many HEIs have achieved a fairly respected status, thus driving vertical differentiation, both as recognised by the government and in the market driven rating systems, and they continue to perform critical functions in supplying the nation with qualified graduates.

Multiple political, demographic, economic and social currents underpin the dynamics of the HE system in the country. Although the most visible agency of change remains in the hands of the government, the role of the academic staff, students and employers is becoming more and more noticeable and impactful, which is being gradually recognised via official mechanisms (the Quality Assurance Agency). Still, many of the factors influencing change are not fully incorporated into conscious decision-making processes or influential debates, which perpetuates the bottleneck in the communicating vessels metaphorically representing various stakeholders. Low levels of trust, divergent points of view on the suitability of quality and functions of higher education and lack of dialogue amongst

stakeholders hold the developments back but may also be maintaining an illusory equilibrium which is needed for stability and continuity. Having outgrown the country's needs, the HE system is now viewed as being in need of closures and mergers of individual HEIs. This process is inevitably painful and fear-inducing at the institutional level as well as that of individual academics and university graduates. It may be a necessary undertaking but how it is managed will make a big difference for the future health and stability of the system. Top-down threats, even when justified, still echo painfully in the post-communist mindset and demand special care in the implementation process. Ironically, the government appears to lack precisely the understanding of the implementation processes and mechanisms required to ensure a smoother and less traumatic experience for stakeholders at the lower levels. Although the Western literature is full of such recommendations concerning implementation of reforms, it rarely takes into account the depth of pre-existing disturbances that proliferate in post-Soviet societies (e.g. Bittner 2014). Ukraine, like other post-Soviet states, needs to find its own path to continue modernising and organising the HE system more effectively, reflecting its specific geographical location, demographic trends, including the levels of mobility amongst young and intelligent students, history and future prospects, whilst maintaining a fragile equilibrium. The uniqueness of one's path, however, does not preclude collaboration or seeking support from outside actors, both Western and from fellow post-Soviet states. The devil as always hides in the details.

NOTE

1. This chapter refers to contemporary Ukraine's territory as recognised by the United Nations unless explicitly stated otherwise.

BIBLIOGRAPHY

- Bilaniuk, L., and S. Melnyk. 2008. A Tense and Shifting Balance: Bilingualism and Education in Ukraine. *International Journal of Bilingual Education and Bilingualism* 11 (3–4): 340–372.
- Bittner, S. 2014. *Myth, Memory, Trauma – The Stalinist Past and the Post-Soviet Present*. Russian History Blog. Available at: <http://russianhistoryblog.org/2014/05/myth-memory-trauma-the-stalinist-past-and-the-post-soviet-present/>. Accessed 3 Oct 2016.

- Buhalo, C.M. 1945. Sostoyanie i Ocherednye Zadachi Vyzov Ukrainy. *Vestnik Vyshey Shkoly*.
- Bunina, L.M. 2013. Istoriya Vyshoi Osvity Ukrainy. *UDK 378 (09): 477*.
- Byron. 2001. Conflicts Over Language Impede Ukraine's Higher-Education System. *Chronicle of Higher Education* 00095982, 47(21).
- Cabinet of Ministers of Ukraine. 2011. *Deyaki Putannya Upravlinnyya Vyschymy Navchalnumu Zakladamy*. 1191-p, Kiev, November 16.
- . 2015. *Pro Likvidaciyu Vyschogo navchalnogo Zakladu 'Luhanskyi Derzhavnyi Institut Zhytlovo-komunalnogo gospodarstva i budivnytva'*. № 656-p, Kiev, June 26.
- Democratic Initiatives Foundation. 2015. *Survey of Rectors Results*. Available at: www.dif.org.ua. Accessed 30 Sept 2016.
- Fedorchenko, Y. 2016. *Reform of Higher Education*. Available at: <http://osvita.ua/vnz/reform/50808/>. Accessed 30 Sept 2016.
- Fimyar, O. 2010. Policy Why(s): Policy Rationalities and the Changing Logic of Educational Reform in Post-communist Ukraine. Post-socialism Is Not Dead: (Re)Reading the Global in Comparative Education. *International Perspectives on Education and Society* 14: 61–91.
- Huisman, J., V.L. Meek, and F.Q. Wood. 2007. Institutional Diversity in Higher Education: A Cross-National and Longitudinal Analysis. *Higher Education Quarterly* 61 (4): 563–577.
- Janmaat, J.G. 2008. Nation Building, Democratization and Globalization as Competing Priorities in Ukraine's Education System. *Nationalities Papers* 36 (1): 1–23.
- Johnston, D.B., and O. Bain. 2002. Universities in Transition: Privatisation, Decentralisation, and Institutional Autonomy as National Policy with Special Reference to the Russian Federation. In *Higher Education in the Developing World*, ed. D. Chapman and A. Austin, 45–68. Westport: Greenwood Press.
- Kovryga, O., and P.M. Nickel. 2006. In a Cycle of False Necessity? escaping from Embedded Quasi-Institutions and Building a New System of Public Administration and Management in Ukraine. *International Journal of Public Administration* 29 (13): 1151–1166.
- Kurbatov, S. 2014. Before Massification: Access to University Education in Ukraine in 1950s–1980s. *International Review of Social Research* 4 (2): 75–86.
- Law on Education. 1991. Kyiv: Parliament of Ukraine.
- Law on Higher Education. 2002. Kyiv: Parliament of Ukraine.
- . 2014. Kyiv: Parliament of Ukraine.
- Ministry of Statistics. 2003. *Statystychnyi shchorychnyk Ukrainy za 2002 rik*. Kiev: Konsul'tant. (statistical yearbook of Ukraine for 2002).
- Narodnoe Obrazovanie i Kultira v SSSR. 1989. *Statisticheskii Sbornik*. Moscow: Finansy i Statistika.

- National Aviation University. 2015. Sergiy Kiv is lying. *Reiderske Zaboplennya*. Available at: Reider-nau.com. Accessed 30 Sept 2016.
- Osipian, A. 2008. Transforming University Governance in Ukraine: Collegiums, Bureaucracies, and Political Institutions. *Munich Personal RePEc Archive Paper*, No. 11058. Available at: <http://mpra.ub.uni-muenchen.de/11058>. Accessed 3 Oct 2015.
- Osvita.ua. 2016. *Consolidated University Rankings*. Available at: http://osvita.ua/legislation/Vishya_osvita/25395/. Accessed 30 Sept 2016.
- Parliamentary Decrees. 2002. *On the Results of the Parliamentary Hearings 'On the Implementation of the Education Laws'*. No. 210–215, October.
- Presidential Decree. 1995. *On the Main Directions of Higher Education Reform in Ukraine*. No. 832/95, September.
- Semiv, L., and Y. Hvozdo vych. 2012. The Intellectual Migration of the Youth in Ukraine: The Backgrounds for 'Brain Circulation'. *Journal of International Studies* 5 (2): 72–81.
- Shaw, M., D. Chapman, and N. Rumyantseva. 2013. Organizational Culture in the Adoption of the Bologna Process: A Study of Academic Staff at a Ukrainian University. *Studies in Higher Education* 38 (7): 989–1003.
- Silova, I. 2009. Varieties of Educational Transformation: The Post-socialist States of Central/South Eastern Europe and the Former Soviet Union. In *International Handbook of Comparative Education*, ed. R. Cowen and A.M. Kazamias, 295–320. Dordrecht: Springer.
- State Office of Statistics of Ukraine. 2015. *Publikacia Dokumentov Gosudarstvennoi Sluzhby Statistiki Ukrainy*. Available at: <http://ukrstat.org>. Accessed 30 Sept 2016.
- . 2016. *Publikacia Dokumentov Gosudarstvennoi Sluzhby Statistiki Ukrainy*. Available at: <http://ukrstat.org>. Accessed 30 Sept 2016.
- Teichler, U. 1988. *Changing Patterns of the Higher Education System*. London: Jessica Kingsley.
- Times Higher Education. 2015–2016. World University Rankings. Available at: <https://www.timeshighereducation.com/world-university-rankings/2016/world-ranking>. Accessed 30 Sept 2016.
- World Economic Forum. 2011–2012. *World Economic Forum Global Competitiveness Report*. Geneva, Switzerland.
- Yershova, O., and A. Gordiichuk. 2013. University Autonomy in Ukraine: International Experience and National Interests. *American Journal of Educational Research* 1 (11): 472–476. doi:10.12691/education-1-11-3.

Nataliya L. Rumyantseva is a senior lecturer at the University of Greenwich, London, United Kingdom. Her research interests include higher education management and policy, leadership development and ethics in education in the developing nations. Nataliya is very sympathetic to the struggles that Former Soviet Union nations are confronting in order to overcome the setbacks and develop their own sense of identity whilst at the time fitting in with the international and global developments. Her research aims to offer a compassionate and yet critical approach in order to enable growth and development beyond imagination. She is particularly interested in enhancing understanding of inner workings of the higher education systems through the lens of ethical issues, paradoxes and professional development of academic staff and management. She is currently involved in the Tempus Project (ELITE) on Higher Education Leadership Development with seven Ukrainian partner institutions.

Olena I. Logvynenko is a *dotsent* at the Department of Theory and History of State at the National University of Life and Environmental Sciences, Ukraine. A lawyer by training, Olena has served as a professor and a Head of Department in several Ukrainian institutions for over 5 years. A prolific researcher, Olena concentrates on the issues of women's rights, children's rights and broader ecological human rights from the contemporary and the historical perspectives. Olena is now extending her interests into the area of higher education studies applying the principles of ecological perspective.

Open Access This chapter is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, duplication, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

