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Problems of realization of the intellectual component of innovative development of Ukraine

Abstract

The realization of the intellectual component is an important task in the context of the Fourth Industrial Revolution and the development of technology. The country's place on the global economic map is not least determined by the availability of resources and efficiency of their use, it can determine both the competitiveness of the economy and its opportunities in the future. Under the conditions of a market economy and the transition to a new technological system, the role of certain factors that in the previous technological systems ensured the competitiveness of the economy changes. Those that can ensure the singular development of the economy and its nonlinear progress come to the fore. First of all, it is knowledge-forming and knowledge-producing factors that can ensure innovative development and, especially, the development of fundamentally innovative products or innovative breakthroughs. This involves the intensification of investment activities in innovation, the use of broad financial and administrative tools, as well as the development of innovations in management systems and the formation of creative and innovative components of economic activity. All this, in turn, involves the formation of a holistic strategy for the development of the innovation ecosystem, which has a high efficiency of implementation given the practice of developed countries and countries that have formed their competitiveness on the basis of intelligence. The combination of such factors should facilitate the entry into the market of new competitive goods and services, which in the age of digitalization and networking will form new advantages of using existing opportunities.

Keywords

intellectualization,
intellectual capital,
human capital,
intellectual leadership

JEL: I23, I25**1 Problem statement**

Achieving high positions in the era of intellectualization is possible in two key ways - the use of own resources and attract them from external sources. However, the mere availability of resources does not provide a qualitative breakthrough, so active government support is needed in areas where material resources are the necessary basis for the materialization of the use of these resources and the commercialization of intellectual activity.

Ukraine is not one of the world leaders in terms of intellectual performance, which is embodied in innovative products, although in some respects it is not the last place. Analyzing the state of innovative development of Ukraine, it should be

noted that the country's indicators are quite high in terms of intellectual leadership of the first order, in terms of intellectual resources. Ukraine is among the top 10 countries in the world in terms of higher education expenditures as a share of GDP, but such indicators are the exception rather than the general trend; in addition, the number of nominees of Ukrainian origin is quite significant among the Nobel laureates, but they gained world recognition without representing Ukraine.

To outline the ways and directions of activating the implementation of the intellectual component of innovation development, it is necessary to identify the main problems and bottlenecks for the development and increase the intensity of innovations and their financial efficiency. Ukraine's place among the analyzed countries is in the last

echelon, and it mostly closes the ratings according to the selected indicators.

2 Analysis of recent researches and publications

In the scientific literature, one of the most pressing issues is the theoretical and methodological understanding of the essence of innovation processes and their drivers, the role of knowledge, education and technology in ensuring the economic progress of society. In the 50s of the twentieth century, Robert Solow substantiated the model of exogenous economic growth on the basis of the production function of Cobb-Douglas and the Keynesian model of economic growth R. Harrod-E. Domar [32]. In the future, research begins to take into account in more detail the various aspects of the main factors (labor, capital, land) and scientific and technological progress. Current research continues to analyze the factors and processes of economic growth due to deeper dependencies. Robert Tamura, Gerald Dwyer, John Devereux and Scott Baier investigate the relationship between human capital accumulation and the dynamics of long-term growth (2012; 2019) [25]. Based on research by Maddison A. [20], they proposed a simple model of human capital accumulation and physical capital accumulation within the standard Cobb-Douglas production function. The results of the model explain 70 to 80 percent of long-term economic growth by differences in employee characteristics. New research (2019) [25] has shown that a change in an employee's baseline data can explain up to 46% of changes in long-term growth. Thus, the accumulation of human capital over many generations can explain up to half of all long-term changes in living standards.

The purpose of the article is to identify the main problems of development of the Ukrainian economy and key factors influencing its growth.

3 Research results

In this study, three key levels of intellectual leadership are identified: resource (first-order leadership), intermediate results (second-order leadership), and end results (final, end results) (third-order leadership). All resource factors are conventionally divided into main groups: financial, human resources and their quality and intellectual resources. The state of financial resources and the actual financing of the activation of intellectual potential in Ukraine is not bad, and since these are common factors, their effectiveness is relatively low. In general, spending on education has increased since 2005, but we can see that their reduction in 2018 compared to 2010 exceeded 30%; The situation is similar with regard to public

spending on higher education in millions of dollars. In general, in 2018 there was a reduction of almost all financial indicators compared to 2010 and almost full compliance with them or an increase relative to the indicators of 2005. Thus, the growth of public spending on education and higher education in millions of dollars. compared to 2005 it was 50% and 60% respectively, but since 2011 we have seen a decrease of 22% and 30% respectively. Public spending on higher education as a share of all public spending compared to 2005 increased by 2%, compared to 2011 there was a decrease of 11%. Given that Ukraine's GDP grew during this period, this reduction is evidence of negative trends in the economy [5;8;9;10;12].

In general, the level of public spending (as a share of GDP) on education remains at the level of the world average and is higher than, for example, in the UK, Turkey, USA, Switzerland, Spain, Slovakia, Singapore, Poland, Lithuania, Japan, Italy, Ireland and Germany [8].

In terms of expenditures on higher education as a share of GDP, Ukraine is not the last place and in general the figure is 1.85% higher than the United States, Great Britain, Australia, Austria, Belgium, Brazil, Canada, France, Germany, Portugal, Spain, South Korea and other analyzed countries. In general, higher indicators than in Ukraine, only in Norway, Denmark and Sweden [11].

Ukraine's public spending on higher education is also at a level that corresponds to the leading countries. The median value is set at 3.21%, while Ukraine shows 4.14% of national expenditures and is in the same group with countries such as Turkey, Norway, New Zealand, Mexico, China, Chile, Canada, Denmark [12].

However, the share of expenditures in itself is not indicative, as Ukraine's GDP is not very high, in fact the real level of expenditures is extremely low. Thus, the cost of education in Ukraine in 2018 was only 20% of Turkey's spending and only 5% - of the UK's spending. Less Ukraine is spent only by low-income countries, including Estonia, Hungary, Latvia, Lithuania, Luxembourg, Slovenia and Slovakia [9], where only 6% of UK spending and 17% of Turkish spending are spent on higher education. If we compare with countries with a population close to Ukraine, Ukraine lags far behind here - Ukrainian spending is 67% of Colombia's spending and 38% of Poland's spending on higher education [13]. In general, expenditures on education and higher education in particular are not characterized by homogeneity and Ukraine has a stable position only in relative terms, but their absolute expression indicates the weak position of Ukraine, which is caused by the weakness of the Ukrainian economy as a whole.

The second group of resources includes human resources and their quality, including the number

and mobility of students. As the analysis shows, the number of students in Ukraine is quite significant [1; 2; 3; 4; 18; 34]. In general, Ukraine shows divergent trends in this group of indicators, in particular, in terms of student numbers, declining trends are observed at almost all levels. Thus, the number of students at ISCED 5 (short-term courses) has decreased by more than 22% since 2005, as well as at ISCED 6 (bachelor) (a decrease of 21% compared to 2013). At the educational qualification level ISCED7 (master), the reduction was almost 30% compared to 2013. However, the number of students at ISCED 8 (PhD) level increased by 4% compared to 2005. The number of short-term students in Ukraine is quite high and 65% higher than in the United Kingdom, but is only 6% of the number of short-term students in the United States. Poland's active and aggressive policy in the market of educational services has a negative impact on the Ukrainian market, attracting students with its market offers [2].

The next group of indicators concerns student mobility and Ukraine's participation in global academic mobility flows. In 2018, our country recorded 1.2% of the global flow of students who entered Ukraine to study. Switzerland, New Zealand, Belgium, and Austria had the same level [18]. In terms of student outflows, Ukraine represents 1.6% of the global flow and is on par

with Canada, China, Italy, Russia, the United States, and Turkey [33].

In general, the net influx of foreign students to Ukraine is quite volatile [22]. However, in recent years there has been a steady trend to reduce the attractiveness of Ukraine and reduce the number of students coming to Ukraine. In general, Ukraine's place in the global market of educational services is quite ambiguous, due to significant fluctuations in the country's attractiveness for students. The United States, Great Britain, Switzerland, Sweden, Spain, Singapore, Russia, Portugal, Norway, New Zealand, the Netherlands, Japan, Italy, Hungary, Germany, France, Finland, Denmark, the Czech Republic, Canada, Austria and Austria have a high and stable level of attractiveness. Australia [22]. The situation close to Ukraine is observed in Turkey, Ireland and Poland. In Poland, the positive balance has been observed only in recent years, but the increase is quite significant, averaging 10,000 students each year.

Analyzing the geographical structure of academic student migration, we note that most foreign students come to Ukraine from Azerbaijan (Table 1).

Ukrainians also travel to Latvia, Sweden, Finland, Lithuania, Portugal, Estonia, Argentina, Australia, Belgium, the United Arab Emirates, Moldova, Denmark, Cyprus, Armenia, Japan,

TABLE 1 Geographical structure of Ukraine's participation in the processes of academic migration (TOP-20), persons, 2018

Country of origin	Number of students	Country of destination	Number of students
Azerbaijan	6726	Poland	34692
Turkmenistan	3679	Russia	15263
India	7669	Czech Republic	3015
Nigeria	2742	Italy	2775
Morocco	3538	USA	1744
Georgia	2114	France	1339
Jordan	1752	Austria	1357
Uzbekistan	1872	Hungary	1193
Turkey	1406	United Kingdom	910
Iraq	972	Canada	1146
China	1539	Slovakia	1265
Egypt	1887	Israel	1537
Russia	783	Bulgaria	570
Israel	1537	Turkey	579
Ghana	1246	Spain	410
Moldova	694	Switzerland	358
Poland	678	Belarus	363
Lebanon	674	Greece	246
Syria	438	Norway	205
Ecuador	463	Romania	248

Source: Systematized by the author for: [7]

South Korea, Georgia, Slovenia, and Saudi Arabia. Kazakhstan, New Zealand. In general, input mobility is lower than the output and is 4.6% (Table 2).

TABLE 2 Key indicators of student academic migration in Ukraine, 2018

Key indicators	Value
Students abroad	
Total number of students abroad, persons	77639
Coefficient of initial mobility	4,7
Academic immigration	
The total number of immigrant students, persons	49632
Incoming mobility	3,1

Source: [7]

Ukraine's participation in global student migration flows has increased significantly over the period, and the number of Ukrainian students studying abroad has almost tripled since 2005, with an overall increase of 185% relative to baseline indicators. Regarding the involvement of foreign students in the higher education system of Ukraine, the trends are quite close - the figures for 2018 are 233% compared to 2005. At the same time, the migration balance of students was in a positive plane for almost the entire period, which indicates the attractiveness of Ukrainian education for foreign students, but in 2015 and 2016 the balance showed a steady decline and became negative.

The last block of leadership indicators of the first order includes indicators of the actual intellectual component and is determined by the number of scientific and technical staff in its various dimensions (both in general and in terms of millions of population or thousand employees) [27; 28; 29].

In terms of intellectual indicators, Ukraine's place is gradually deteriorating, and since 2005 there has been a reduction of more than 40% in all indicators. Thus, the total number of research staff decreased by 44%, in terms of one million population, the reduction was 43%, and the number of research staff per thousand employees decreased by 41%. Although in general Ukraine remains not in the last place in terms of key world trends, but negative trends indicate a deterioration of the situation as a whole. According to the indicators of the total number of research staff, Ukraine is in the same group with Austria, Belgium, the Czech Republic, Sweden and Switzerland [29].

In all these countries the population is quite high, because in India and Turkey the total number of scientists is much higher than in Ukraine. We must emphasize that the trends indicate a decrease in the number of scientific staff on all indicators - and in general, and per million population, and per thousand employees [27].

We can note that in general in Ukraine there is a good position on the availability and financing of the resource component, but with the growth of intellectualization of resources indicators gradually

deteriorate, indicating low efficiency of intellectual potential and the need to develop new innovative tools for its implementation and commercialization.

The assessment of second-order intellectual leadership in Ukraine confirms the dynamics and main trends of first-order leadership. Lower-order resources in Ukraine are at a higher level of development, but if we are talking about qualitatively higher resources or the results of their commercialization, then the trends indicate negative trends. All indicators of second-order intellectual leadership are divided into educational-scientific, infrastructural and technological. Educational indicators include the number of world-class universities, scientific and technical publications and Nobel laureates [23; 30].

In general, Ukraine has a rather weak position in terms of educational and scientific indicators. As for world-class universities, Ukrainian higher education institutions are represented in the ranking of the 1000 best universities in the world in different periods - from 1 to 5 universities. There are persistent positive trends in the growth of the number of scientific articles in cited and peer-reviewed publications; since 2005, growth has taken place by almost 24%, but such rates are insufficient in light of global trends. It is worth noting the relationship between two key indicators - the number of scientific staff and their effectiveness through the publication of intellectual performance. By the way, the informativeness of this indicator depends on the general indicators of the number of scientific staff. Ukraine is at the bottom of the list of selected countries in terms of the number of publications, sharing the place with New Zealand, Ireland, Chile, Hungary and Colombia, but it should be noted that the number of scientific staff in New Zealand is three times lower than in Ukraine. 42% of the indicators in Ukraine, in Chile - 18%, in Hungary - 45%. That is, despite the relatively high position of Ukraine in the number of research staff, its efficiency and effectiveness in publishing the results of the study are quite low [29]. At the same time, countries close to Ukraine in terms of the number of R&D staff on a full-time and part-time basis have much

higher figures for the number of publications in peer-reviewed publications. Austria, Denmark, Portugal and Belgium show at least twice the number of publications with relatively equal scientific staff.

The number of Nobel laureates in Ukraine during the analyzed period is static and includes, according to various estimates, from 2 to 5 people (taken into account since Soviet times, the last prize in 1992). Among all the countries of the world in terms of the number of Nobel laureates, Ukraine belongs to the most represented bloc of countries. The undisputed leader is the United States of America, which has 368 winners, in the same group with Ukraine Luxembourg, East Timor, Bosnia and Herzegovina, Liberia, Belarus, Portugal, Greece, Guatemala, Chile, Algeria, Colombia, Turkey [23].

Second-order intellectual leadership includes infrastructure indicators that are crucial for the formation of innovation ecosystems. Analyzing the trends of change in infrastructure indicators, we must say about two different trends - on the one hand, the number of fixed line users is steadily declining, the reduction per 100 people is an average of 1.5% annually, a total of almost 20% over the analyzed period. Given that only 20% of users have a fixed connection, there is a clear trend. The total number of users is declining even more - by almost 30% and 2.5% annually. On the other hand, the number of users of the latest means of communication has increased sharply over the analyzed period, for example, secure Internet servers increased by almost 3000% (both in total and in terms of 1 million population). The share of individual Internet users also increased to 52%, which is 1397% of the 2005 indicators.

The smallest increase among new technological communication products is observed in terms of mobile users, in general their number increased by almost 89%, per 100 people the increase is 214% (ie since 2005 the share of users has increased by 114%; by the way, there are 135 mobile users per 100 people, such indicators are caused by the peculiarities of the legislative regulation of mobile telephony in Ukraine and the impossibility of preserving the telephone number when switching to another operator).

In general, the number of individual Internet users in Ukraine, despite the positive trend, lags far behind world leaders and remains at the level of world averages. However, among the selected countries, Ukraine has the penultimate place, it is ahead of only India. Iceland (98%), Luxembourg (98%), Norway (97%), Denmark (95%), Japan (93%), South Korea (93%) and the Netherlands (90%) have the highest rates [19]. The number of fixed line users is growing in some countries, but in Ukraine it tends to decrease. At the same time, the

leading countries show an increasing trend in the number of fixed line users, in particular France, Hong Kong, South Korea, Japan and Portugal [6].

A positive phenomenon is the presence and dynamics of secure Internet servers, Ukraine is one of the first places in the world in terms of their number per 1 million population. In the same group with Ukraine, Russia, Chile, China and Singapore, but Ukraine is three times higher than, for example, Singapore, and is the leader among the analyzed countries (OECD +) [31]. The number of mobile telephony users is also high. Ukraine is among the TOP-10 world leaders in this indicator, but the leader of Hong Kong is almost 100% higher than Ukraine [21].

Regarding the last block of this group of indicators (including intellectual property rights), Ukraine does not show significant changes and we even see a certain decrease, such as the total number of patent applications, a decrease in both residents and non-residents. Ukraine's indicators are close to those in Poland, but the dynamics are completely different - Poland is showing a gradual increase, like most OECD countries [24].

The third group of indicators of intellectual leadership of the second order includes indicators of manufacturability, which reflect the results of intellectual activity, mainly embodied in patents and licenses. In general, according to this group of indicators, Ukraine shows steady growth in almost all of these indicators. The decrease occurred only in the share of information and communication goods in the structure of imports (which may indicate import substitution) and in the number of patent applications, where the decrease was 27%. Among intellectual property rights applications, trademark applications increased by 16% and industrial designs by 387%, but compared to the latter, their structure is heterogeneous: by 2009, the number of applications from residents significantly exceeded applications from non-residents, but in recent years For 8 years, the number of applications from non-residents has significantly exceeded. The development of information and communication technologies makes it possible to assert the strengthening of Ukraine's capabilities to ensure international competitiveness, strengthen its position in the international market and achieve global leadership in certain indicators.

Regarding the trends in the export of knowledge-intensive services as a share of total exports of services, it should be noted that growth is almost 5 times, and Ukraine's place among developed countries is quite stable in terms of growth and size. Among the analyzed countries, the largest share of exports of ICT services is in Israel, India, Ireland and Brazil, where their share exceeds 50%, and the leader of Israel has almost

70%, which is twice the figure of Ukraine [16]. Ukraine has close indicators to Austria, Great Britain, Germany, France, Hungary, Singapore, Slovakia, the Netherlands, Norway, Poland,

Colombia, Russia and Canada. However, among these countries, Ukraine has the highest growth rates (Figure 1).

Thus, in 2017, almost all countries held the

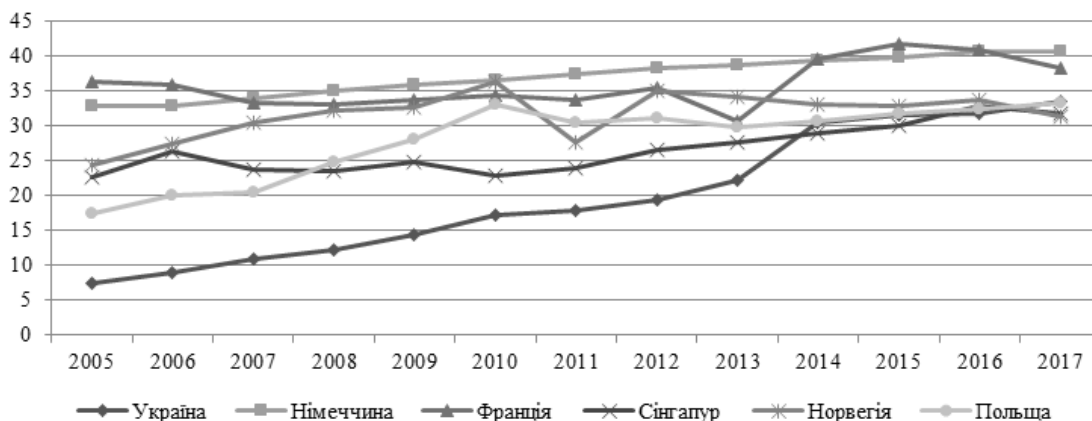


Figure 1 Dynamics of exports of ICT services, selected countries, % of exports of services
Source: [16]

same position, only Ukraine in 2005 had much lower rates. In fact, Ukraine has such a high position due to the IT sector and outsourcing, which are actively used in the development strategies of the highest performers, in particular, India, Singapore, Israel and Ireland have a highly developed information technology sector and actively represent their interests in the global market. The formation of the services sector is simpler from an economic point of view and requires less financial resources and time to develop this type of business. The active development of information technology is also indicated by indicators of the infrastructure of second-tier leadership, in particular, a significant share of Internet users, the number of secure Internet servers and the dynamics of their growth.

Analyzing the indicators of exports of services in physical indicators, we see an excellent picture, because all countries that have a close share of exports of services, significantly exceed Ukraine in monetary terms. Thus, in terms of value, exports of services in Ukraine are only 8% of the Netherlands, 22% - of Austria, 9% - of Singapore, 24% - of Poland and 27% - of Russia. The share of the Czech Republic is lower - 52%, Norway - 40% and Hungary - 60% [17]. For example, Ukrainians make up only 2% of the United States, and the experience of Singapore is impressive, which, despite its small size and lack of natural resources, has implemented a strategy for the development of the information and communication sector. services. Given the difference in the GDP of world leaders and Singapore, the value of exports of high-tech services is extraordinary.

However, among the selected countries, Ukraine

has not the last positions and exceeds the indicators of Colombia (by 247%), Lithuania (by 232%), Latvia (by 228%), Slovenia (by 138%). As most of these countries are much smaller in terms of both population and economic activity, such an excess is not evidence of a high level of economic development in Ukraine. The positive for this indicator is its unconditional sixfold growth over the period.

The next indicator is the import of ICT goods in the structure of total imports. During the analyzed period, Ukraine shows a constant indicator at the level of 4% of total imports of goods; in general, this level is lower than the average for the selected group of countries - 10.2%. These figures are approximately on a par with Greece, Spain, Slovenia, Switzerland, Luxembourg and Portugal, lower than Ukraine among selected countries only in Belgium [15]. Low rates are quite a positive fact, as they indicate a low involvement of imported goods; however, it also confirms the country's low involvement in global value chains. For example, South Korea has one of the highest levels of exports of high-tech products, but the share of imports of ICT products is almost 15%, as South Korea actively imports parts and components for Samsung products from Japan, thus forming product chains and sharing equal stages production between several countries, although the final product belongs to South Korea. This is confirmed by the indicators of exports of ICT goods, which in South Korea already account for 22%.

Almost all countries during the analyzed period show a decrease in exports of ICT goods in the structure of total exports. However, Ukraine is gradually increasing this figure, which indicates a gradual strengthening of its place in the Fourth

Industrial Revolution and increasing technological potential in the world. Overall, growth was almost 100%, but even with this growth, the share of ICT goods is less than 1% of total exports. Only Israel, Singapore, Slovakia, Latvia and Poland showed significant growth during this time. At the same time, Israel shows growth by 90%, Singapore - by 110%, Slovakia - by 76%, Latvia - by 500%, Poland - by 107%. Despite Latvia's extraordinary growth rate, the share of ICT goods in its exports is only 11%; this is at least three times higher than the leading countries - Singapore with a share of 33%, China with a share of 26% and South Korea with 22%. An important issue is the trade balance of ICT goods. Thus, in Ukraine, imports exceed exports by almost 4%, which proves that Ukraine is a consumer in this market; at the same time, South Korea shows a positive balance (7%), China - 3%, Singapore - 5%.

The next indicator for the analysis is high-tech exports, the share of which in Ukraine is 7% of total exports in 2015, and this is one of the lowest indicators among the analyzed countries, the leader among which is Singapore with a record 48%. Overall, more than 20% of high-tech products from exports in 2016 were demonstrated by Ireland (29%), Switzerland (27%), France (26%), South Korea (26%), China (25%), Iceland (23%), and the United Kingdom. (22%), United States (20%) [14].

Among the positive trends is the increase in the value of high-tech exports by 56%, which given the significant growth of the dollar over the period indicates the presence of positive trends in the structure of Ukraine's economy. The share of high-tech exports is quite volatile, but has a relatively stable upward trend. At the same time, the cost of high-tech exports peaked in 2012. Very few countries show an increase in the share of high-tech exports, low growth dynamics in Switzerland,

France, Norway, Israel, Australia, the Czech Republic, Belgium, Latvia, Lithuania, Greece, Russia, Slovakia, Colombia, Poland, Slovenia, India and Turkey. Moreover, countries with a lower level of development show higher growth rates of the share of high-tech exports relative to highly developed ones, but world leaders in general show a decrease in this indicator.

4 Conclusion

Thus, the analysis of key indicators of intellectual leadership of different order gives grounds to claim that most values in Ukraine are in the negative plane and need significant adjustment. Various taxonomic factors reflect the key negative trends in the intellectualization of Ukraine's economy, the analysis of global trends indicates the need to increase intellectual potential and its effectiveness. According to most of the selected indicators, Ukraine does not even reach the medial values, exceeding these values only in some indicators, but most often in terms of growth rates, and not in terms of the nominal value of the indicator. A comparative analysis of the development of the Ukrainian economy has revealed its role in the global environment and the multistructural ties that play a crucial role. Accordingly, the key problems of realization of the intellectual component of innovative development of Ukraine are identified, the minimization of the negative impact of which can be ensured by the active introduction of inclusive institutionalization of public administration. This is aimed at the growth of freedoms, market exchange of resources with the support of the state. The structural dynamics of the factors of intellectualization indicates the need to demarcate state influences on various manifestations of intellectualization.

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