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Mobility of the Workforce and Its Influence on Innovativeness (Comparative Analysis of the United States and Poland)

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Abstract
The article describes a comparative analysis of the mobility of the workforce in the United States and Poland. The collected data includes permanent relocation as well as temporary travel abroad. Data also includes the reasons being taken under consideration while relocating. The paper also discusses the phenomenon of innovative people cloistering together and creating innovative cities. The article also addresses the influences of mobility of the workforce on innovative and entrepreneurial behavior. A comparison has been made between the innovativeness in the most innovative cities in the United States and Poland. This comparison also includes the percentage of people with higher education in the most innovative cities in the United States and Poland. The percentage of the immigrant population in the most innovative cities in the United States in comparison to the national average has also been provided. Since there is no accurate data related to the number of immigrants in the most innovative cities in Poland, a comparison between the United States and Poland was not possible.

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1. Introduction

The mobility of the workforce is beneficial for the economy because the supply of workers with certain skills meets the demand of the economy. This allows for more efficient and productive use of human skills and resources. It has been proven that the mobility of the workforce is conducive toward innovative and entrepreneurial behavior. The mobility of the workforce leads to the creation of pockets of highly innovative individuals gravitating toward each other. This leads to the establishment of highly innovative cities leading the economy to prosperity. The comparative analysis provided in this article can be used to identify the best practices in managing an innovativeness and entrepreneurial network.

2. Aims

The primary aim of the article is a comparative analysis of the mobility of the engineering workforce in the United States and Poland. The influence of the mobility of the workforce on creativity and innovativeness is also being discussed. The data provided in this article can be helpful in managing innovativeness and entrepreneurial networks.

3. Selection of the Research Sample

During the data collection process a survey was conducted among engineers working for industry. Based on a pilot study, the required size of the sample was calculated to be ninety-two. A larger sample size would increase accuracy, but it would also include the cost of the project. The survey was conducted in a post-coalmining region in Northeastern Pennsylvania and the Slask Region in Poland.

4. Limitation of the Research Project

The survey conducted in the United States was focusing on Northeastern Pennsylvania which was historically a coalmining region. The survey conducted in Poland was administered in the Slask Region. Both regions have a similar history. Therefore, both regions were selected for the comparative analysis. However, these areas may not be a good representation for the entire country. For a better comparison between

the two countries, the research would need to include other regions in those two countries.

5. Literature Review

There are many perspectives in the scholarly literature dealing with the mobility of the workforce. Richard Florida conducted research about the *rise of the creative class*, (Florida, 2012a; Florida, 2002). Florida investigated the reasons why innovative individuals gravitate toward larger metropolitan cities, e.g. (Florida, 2018; Florida, 2012b; Florida, 2010; Florida, 2005). The problem of workforce mobility can be analyzed in the context of economic migration (Kuzior, et. al, 2020) and social migration related to COVID-19 (Sommarribas and Nienaber, 2021). However, there is very limited literature specifically related to the mobility of the engineering workforce and its correlation with creativity and innovativeness. This article aims to address that research gap while approaching the problem from the perspective of a comparative analysis between the United States and Poland.

In this article, the author refers to her previous publications (Grebski, 2021; Czerwinska-Lubszczyk, et.al., 2020; Grebski and Wolniak, 2018; Grebski, W. and Grebski, M., 2018). The topics of creativity and innovativeness are often approached in the literature within the context of ethics and sustainable development (Bedarova et al., 2018; Kuzior and Lobanova, 2020; Kuzior and Lobanova, 2020; Kwilinski, et.al., 2019; Kuzior and Zozulak, 2019; Fobel and Kuzior, 2019; Shpak et al., 2017; Pachura, 2015; Kuzior, 2010). Deeper analysis requires the use of both a purely observational approach, based on correlations without indicating cause-effect relationships, and an active one, related to the design of experiments methodology (Pietraszek and Goroshko, 2014; Pietraszek et al., 2020), where cause-effect relationships are a priori assumed, and then the validity of these assumptions is verified.

6. Experiment and Data Collection

To assess the mobility of the workforce in the United States (USA) and Poland approximately one hundred engineers employed by industry were surveyed in both countries (98 in the USA and 92 in Poland). The surveyed individuals were asked about the number of times that they relocated in the last 5, 10, 15, 20, 25 and 30 years. The results of the survey are shown in Table 1.

Table 1. Frequency of relocation. (Author's compilation)

Questions (Permanent Relocation)	USA N=98	Poland N=92	Student t-test (Results)
How many times did you relocate during the last 5 years?	M=1.29 S^2=.74	M=0.07 S^2=.06	t=13.01 p=.00001 (Significant difference at α=0.05)
How many times did you relocate during the last 10 years?	M=2.41 S^2=.82	M=00.15 S^2=.13	t=17.43 p=.00001 (Significant difference at α=0.05)
How many times did you relocate during the last 15 years?	M=3.33 S^2=1.12	M=0.24 S^2=.22	t=23.08 p=.00001 (Significant difference at α=0.05)
How many times did you relocate during the last 20 years?	M=4.23 S^2=1.59	M=1.03 S^2=1.54	t=15.80 p=.00001 (Significant difference at α=0.05)
How many times did you relocate during the last 25 years?	M=5.44 S^2=1.62	M=1.41 S^2=.89	t=22.69 p=.00001 (Significant difference at α=0.05)
How many times did you relocate during the last 30 years?	M=6.61 S^2=1.51	M=1.79 S^2=1.09	t=28.05 p=.00001 (Significant difference at α=0.05)

In addition to the question related to relocation, the surveyed individuals were also asked for the number of international trips taken during the same intervals (5, 10, 15, 20, 25, 30 years). Those results are shown in Table 2.

Table 2. Frequency of international travel. (Author's compilation)

How many times did you travel abroad during the last 5 years?	M=3.14 S^2=2.49	M=3.31 S^2=1.43	t=0.780 p=.4364 (No significant difference at α=0.05)
How many times did you travel abroad during the last 10 years?	M=7.12 S^2=1.49	M=6.98 S^2=2.24	t=0.521 p=.532 (No significant difference at α=0.05)
How many times did you travel abroad during the last 15 years?	M=11.04 S^2=2.89	M=10.67 S^2=4.12	t=1.061 p=.291 (No significant difference at α=0.05)
How many times did you travel abroad during the last 20 years?	M=13.07 S^2=10.56	M=13.85 S^2=7.96	t=1.354 p=.178 (No significant difference at α=0.05)
How many times did you travel abroad during the last 25 years?	M=15.97 S^2=6.15	M=16.29 S^2=8.53	t=0.669 p=.504 (No significant difference at α=0.05)
How many times did you travel abroad during the last 30 years?	M=20.71 S^2=24.27	M=22.11 S^2=27.51	t=1.425 p=.1567 (No significant difference at α=0.05)

The surveyed individuals were also asked to rate the factors influencing their decision in relocating to different cities where they would like to live. The results from that survey are shown in Table 3.

Table 3. Factors considered in selecting a city to relocate. (Author's compilation)
(Scale: 5=Very important; 1=Not important at all)

Reason for Relocating	Poland (N=92)	USA (N=98)	Student t-test (Results)
Family Situation	M=3.41 S^2=0.9	M=4.59 S^2=0.31	t=8.5066 p=0.00001 (Significant difference at α=0.05)
Hometown	M=2.45 S^2=0.68	M=4.36 S^2=0.39	t=16.199 p=0.00001 (Significant difference at α=0.05)
Income	M=4.65 S^2=0.25	M=4.68 S^2=0.22	t=0.3789 p=0.7052 (No significant difference at α=0.05)
Cost of Living	M=3.97 S^2=0.75	M=4.55 S^2=0.41	t=4.6556 p=0.00001 (Significant difference at α=0.05)
Social Networking	M=3.83 S^2=0.94	M=2.96 S^2=1.62	t=4.0364 p=0.00001 (Significant difference at α=0.05)
Culture of Freedom	M=4.54 S^2=0.29	M=3.15 S^2=1.08	t=11.008 p=0.00001 (Significant difference at α=0.05)
Culture of Respect	M=4.63 S^2=0.28	M=3.12 S^2=1.9	t=9.9145 p=0.00001 (Significant difference at α=0.05)
Culture of Tolerance	M=4.77 S^2=0.21	M=3.08 S^2=1.02	t=16.319 p=0.00001 (Significant difference at α=0.05)

7. Results and Discussion

The results shown in Table 1 demonstrated a significant difference between the mobility of the engineering workforce in the United States and Poland. During a five-year interval, the engineers in the United States relocated 1.29 times while engineers in Poland relocated .07 times. During the fifteen-year interval, engineers in the United States relocated 3.33 times while engineers in Poland relocated .24 times. During the twenty-five-year interval, engineers in the United States relocated 5.44 times while engineers in Poland relocated 1.41 times. There is a significant difference between the mobility of the engineering workforce at α=.05. The results of the survey shown in Table 2 representing travel abroad (business and pleasure do not show a significant difference between the data collected in the United States and Poland (at α=.05).

The results of the survey shown in Table 3 related to the factors considered while relocating show a significant difference between the data collected in United States and the data collected in Poland. In the United States the most important factors considered while relocating are as follows:

- Culture of tolerance
- Potential for income
- Culture of respect for individuals
- Culture of freedom and democracy

In Poland the most important factors being considered are as follows:

- Potential for income
- Family situation
- Cost of living
- I am native to that city

Poland is a more homogeneous country, so the traditions and values are similar. Therefore, the family situation is often a decisive factor for relocating. The literature analysis indicates that the mobility of the workforce increases entrepreneurial and innovative behavior. Creative and innovative individuals are more likely to be mobile and gravitate to cities with a high number of educated innovative individuals with an entrepreneurial mindset. This phenomenon creates highly innovative cities.

Table 4 contains a listing of highly innovative cities in the United States. By using the number of patents/1000 residents/year as an innovativeness indicator, a comparison can be made between the national average and highly innovative cities. Table 4 contains a list of the most highly innovative cities in the United States with the number of patents/1000 residents/year. The city of Cupertino (California) is the most innovative city with fifty patents/1000 residents/year which is fifty times higher than the national average (.96 patents/1000 residents/year). Table 4 also shows the percentage of people with higher education which is much higher than the national average (33.4%). Table 4 also contains the percentage of people considered as immigrants. In some innovative city in USA that number exceeds 50% which is much higher than the national average (14%).

Table 4. Most innovative cities in the United States. (Author's compilation)

City	Number of Patents/ 1000 Residents/ Year	Immigrant Population	Adult Population with Baccalaureate Degree
Santa Clara (CA)	2.65	37.0%	48%
San Jose (CA)	4.56	35.9%	51%
San Diego (CA)	2.83	23.0%	40%
Mountain View (CA)	1.55	41.2%	40%
Cupertino (CA)	50.0	51.8%	60%
Redmond (WA)	37.13	40.0%	49%
Seattle (WA)	3.17	24.0%	45%
Sunnyvale (CA)	12.60	48.2%	48%
National Average	0.96	14%	33.4%

Table 5 list the most innovative cities in Poland and the number of patents granted per 1000 residents per year. Table 5 also contains the number of people with higher education in the most innovative cities which is higher than the national average of 27.3%.

Table 5. Most innovative centers in Poland. (Author's compilation)

City	Number of Patents/1000 Residents/ Year	Immigrant Population (N/A-No accurate data)	Adult Population with Baccalaurate Degree
Warszawa	0.23	N/A	37.8%
Poznan	0.33	N/A	30.4%
Krakow	0.36	N/A	31.6%
Wroclaw	0.31%	N/A	30.0%
Bialystok	0.39	N/A	27.0%
Olsztyn	0.57%	N/A	29.0%
Kielce	0.37	N/A	29.9%
National Average	0.08	No accurate data	27.3%

In Poland, the population is more homogeneous. In most bigger cities in Poland, innovativeness is higher than the national average, but the difference is up to five to seven times the national average. The average innovativeness in Poland measured in the number of patents/1000 residents/year is .08 compared to .96 in the United States. (See Table 6.)

Table 6. Number of patents granted in Poland and the United States in 2017. (Author's compilation)

Country	Patents Granted	Population (Million)	Number of Patents/ 1000 Residents/Year
Poland	3.097	37.850	0.08
United States	318.828	331.00	0.96

8. Conclusions

The results of the surveys conducted in the United States and Poland have shown significant differences between the mobility of the engineering workforce in both countries. The mobility in the United States was significantly higher than the mobility in Poland. During the fifteen-year period, engineers in the United States changed the city in which they live 3.33 times compared to .24 for their counterparts in Poland. This very difference was also a reason and justification for relocation.

The only common reason for the relocation in both the United States and Poland was the *potential for income.* The other factors mentioned in Poland as a reason given for relocation were *family situation* or *being native to that city.* In the United States the factors mentioned for relocation were *culture of tolerance* and *respect for individuals* as well as *cultural freedom and democracy.* The rationale for the discrepancies can be *stronger family ties* in Poland combined with a *homogeneous population.*

The United States is a very diverse country with traditionally weaker ties to extended family. The higher mobility of the engineering workforce in the United States leads to the creation of clusters of very innovative and entrepreneurial individuals. This phenomenon leads to the creation of highly innovative cities with innovativeness at a level of up to fifty times the national average. Innovative individuals are very mobile and need other innovative people around them to stimulate them, exchange ideas with them and *feed-off each other*.

Normally innovative cities in the United States have a diverse population with a higher percentage of immigrants. Innovative cities have also more highly educated people. This phenomenon does not happen in Poland to that extent because of a homogeneous population and lower mobility.

The innovativeness in larger cities in Poland (Warszawa, Poznan, Krakow, Wroclaw, Bialystok, Kielce, Olsztyn) have a higher-than-average rate of innovativeness.

The number of patents granted in those cities per 1000 residents per year is five to seven times more than the national average. (This is compared with fifty times the average in the United States.)

The mobility of the engineering workforce is conducive to innovative and entrepreneurial behavior. Innovative individuals in Poland do not have opportunities to cluster together to the same extent as innovative individuals in the United States. Clusters of innovative individuals create networks promoting and enhancing innovative and entrepreneurial behavior. The problems associated with the mobility of the workforce can be extended to post-industrial tourism (Kuzior, et.al., 2021).

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劳动力流动及其对创新的影响（美国和波兰的比较分析）

關鍵詞
劳动力发展
创新性
对比分析

摘要
文章描述了对美国和波兰劳动力流动的比较分析。收集的数据包括永久搬迁和临时出国旅行。数据还包括搬迁时正在考虑的原因。论文还讨论了创新型人才聚集在一起打造创新型城市的现象。本文还讨论了劳动力流动对创新和创业行为的影响。对美国和波兰最具创新性城市的创新性进行了比较。这种比较还包括美国和波兰最具创新性城市中受过高等教育的人口百分比。还提供了美国最具创新性城市的移民人口与全国平均水平相比的百分比。由于没有关于波兰最具创新性城市的移民人数的准确数据，因此无法对美国和波兰进行比较。