Chapter 13
The Service Offshoring Code: Location Efficiencies for German Firms

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Abstract Due to unique task characteristics, different location requirements exist, which ultimately lead to unique location considerations. Based on our research, five decision factors are identified for service offshoring: wages, education, infrastructure, cultural distance, and corruption. Considering these decision factors, efficiencies for the offshoring locations are computed with a data envelopment analysis from a German point of view. The research concludes that the most efficient service offshoring countries, with an average efficiency of 97 %, are the Netherlands, Switzerland, the United Kingdom, and the United States.

Keywords Service offshoring · Location efficiencies · DEA

13.1 Introduction

Offshoring can be broadly divided into two segments, namely into manufacturing and service offshoring. Though, on the one hand, manufacturing offshoring (often referred to as outsourcing) has a much longer history, it requires less-educated employees because the advanced functions are completed within the technical and

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engineering departments in the home country and only the assembly process is located abroad. Service offshoring, on the other hand, is a fairly new phenomenon with more advanced needs. As manufacturing offshoring aims primarily to utilize low labor cost, the geographical distance appears to be a significant factor; not only to minimize transportation costs, but also to enable expatriate managers to live at home (Daub 2009). However, offshoring high-value-added activities such as research or programming require an advanced skill set. Therefore, in addition to realizing potential cost savings, service offshoring also aims to increase competence by accessing high-talent labor pools. Furthermore, prevailing manufacturing offshoring aspects such as transportation costs can be neglected for service offshoring projects (Daub 2009).

Our chapter places its focus upon service offshoring for two reasons. Firstly, technological advancements in recent years enable firms to take full advantage of the service offshoring potential. In order to survive the upcoming revolution of services, firms will have to redesign their strategy and restructure their organizations by engaging in the offshoring process. Thus, it is of essential importance to enable service firms seeking offshoring to choose the most efficient locations for their operations to ultimately generate profits (Karmarkar 2004, p. 102). Secondly, service functions are of great importance to firms; however, service offshoring has not been extensively explored in the past. A recent study by Roland Berger Strategy Consultants (Roland Berger/UNCTAD 2004) indicates that among 500 major European firms, only 39 % engage in service offshoring. This reluctance to offshore could also be attributed to a lack of knowledge of potential benefits and to the potential execution (Daub 2009, p. 3); however, there is not sufficient literature in this area. Our study intends to address this gap in the case of Germany.

Our research model builds on a study from Bunyaratavej et al. (2008), though they use the United States (US) as the home country. In addition to adopting the model, our study expands on it in several ways. Firstly, the cultural distance measure is extended by the fifth Hofstede dimension (Hofstede 2001), thereby increasing both the significance and the accuracy of this indicator. Secondly, another measure, the political environment, is added, extending the model by a substantial location factor, which will be argued. Thirdly, the output measures of the research models are shaped to increase their expressiveness. Bunyaratavej et al. (2008) measure the degree of service offshoring activities by the number of projects abroad; hence, they assume that the equality in number of projects in a host country determines an equal level of activity. We relax this assumption in our study, in the belief that the number of projects does not directly indicate a firm's commitment. Therefore, to actually capture the degree of activity, the amount of investment is considered. Besides, since our study investigates data with another location as a starting point, we enable a location based efficiency comparison between Germany and the US.

In a nutshell, this chapter thus focuses on the question: What are the most efficient locations for German firms seeking service offshoring? Efficiency in this context is understood as an input/output ratio, with the input factors being the decision criteria for an offshoring location, and the output measures the performance indicators. Therefore, the following study aims to increase the understanding of the scope of service offshoring for decision makers, by creating an account of where Germany service firms should locate their offshoring activities. Therefore, we look at 27 countries from all continents to pinpoint the most efficient locations from a German point of view. Furthermore, we analyze these country efficiencies in detail with respect to specific location aspects such as infrastructure or cultural difference. This second detailed analysis not only facilitates an increased understanding, but also results in a more precise offshoring location decision, which enables German firms to turn their offshoring investment into a value-creating activity.

13.2 Location Considerations for Service Offshoring

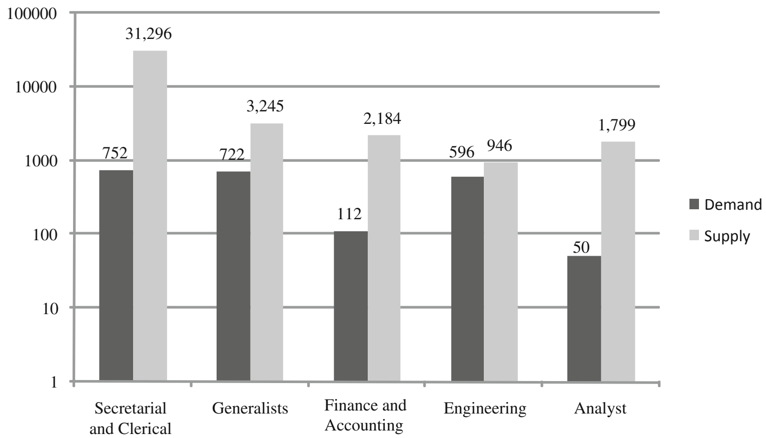
A service job with a qualified employee, a supportive infrastructural environment, and a task that does not require an intense customer interaction may be carried out anywhere in the world. Applying these criteria, 11 % of all service jobs could be offshored globally (Farrell et al. 2006). However, crossing geographical boundaries involves risks and thus proposes several challenges for firms. Therefore, in order to be able to take advantage of offshoring, firms need to assess which locations may serve as the most efficient ones. Based on an extensive literature review, we defined the following five criteria for deciding on service offshoring locations.[1]

13.2.1 Employment and Wage Aspects

One of the main offshoring motives is to reduce wage costs by hiring employees at a lower pay scale than that of domestic employees. Therefore, the local wage level (at the offshore location) is significant in determining the location. However, services require more highly educated employees; therefore, firms must not only consider the wage, but also education level. Current research by Farrell (2006a, b) has showed that the pool of educated low-wage employees has been shrinking over recent last years, especially within the three major offshoring locations of India, Eastern Europe (EE), and Russia. Within the past 15 years, the majority of service offshoring activities have been allocated to Hyderabad, Bangalore, Delhi, Mumbai, Budapest, Prague, and Moscow. Farrell's (2006a, b) research concluded that 90 % of educated low-wage employees are located outside these major regions; therefore, firms need to explore new locations to maintain an efficient education-wage

[1] It yet has to be acknowledged that these chosen inputs may be extended by additional factors such as a country's legal system. Data privacy or patent protection may significantly influence a location's attractiveness. Nevertheless, the chosen input factors are perceived to be the most prevailing aspects and additional ones may add value but solely marginally and thus do not influence the research findings.

ratio (p. 86). This decentralization of talented employees does not, however, result in a demand for low-wage professionals that exceeds the supply. Projections for the year 2008 issued by the McKinsey Global Institute, indicate that the supply significantly exceeds the demand, in particular with regard to secretarial and clerical as well as analyst functions (see Farrell 2006a, b).



13.2.2 Educational Aspect

Seeking talent globally has become the second main motive for offshoring next to the reduction in labor costs (Lewin et al. 2008). It has been concluded that the better educated the employees, the better the delivered service. Thus, the education level of an offshoring location is of significant relevance. Research by Farrell (2006a, b) has shown that in developing countries, the number of university graduates increases by 5.5 % annually while in developed countries by only 1 %. This finding might be partially biased, due to the fact that the base of the developed countries is bigger; however, the fast growth of the developing nations is shrinking the gap (p. 88). Furthermore, there are significant numbers of university graduates available in developing countries. However, the question arises whether the university standards meet Western standards and can be viewed as equal. Studies of the service offshoring potential conclude that in 2008, 19.4 million jobs could have been offshored; however, in practice, only 1.2 million jobs had been offshored[2] (Farrell et al. 2006). One reason for this number is that even though many students graduate from university in developing countries, not all qualify according to Western standards. Farrell et al. (2006) further argue that on average only 13 % of all graduates are qualified to work in a Western high-

[2] The calculations refer to the offshoring potential of the eight most relevant industries which are packaged software, IT services, retail banking, insurance, pharmaceuticals, automotive, healthcare, and retail.

added-value service firm. In contrast, 80 % of Western graduates qualify to work in multinationals (p. 26). Hence, developing nations are shrinking the educational gap solely with respect to the number of graduates, and not necessarily the quality.

13.2.3 Influence of National Culture

It is important to remember that international trade, of which service offshoring is but one dimension, is not merely an economic activity. There are social and cultural aspects that determine the course of success. Social norms and cultural climate affect not only the quantum, but also the quality of international relations (Kamal et al. 2004). Hence, arising cultural differences may prove to be a challenging and even hindering factor in offshoring services to otherwise potentially attractive locations. We utilize Hofstede's cultural research to examine the influence of national culture. Hofstede developed five independent cultural dimensions that define and shape behavior. These are (1) power distance, (2) individualism versus collectivism, (3) masculinity, (4) uncertainty avoidance, and (5) long- versus short-term orientation (Mead 2005, p. 39). In the following, these dimensions are elaborated and furthermore evaluated relative to Germany.

The first dimension, *power distance*, is measured with the power distance index (PDI) and analyzes how employees respond to the inequality of their workplace. Each organization has a hierarchy, be it flat or steep; social status is derived from each distinct level of power. A low PDI results in the employees' willingness to actively participate in the decision-making process and, moreover, to disagree with superiors. If, however, the power distance is great, employees are likely to accept their tasks without reflection. Hierarchies are more respected, and an autocratic leadership style is preferred (Binder 2007). The second dimension is called *individualism versus collectivism* (IDV) and refers to relationships among individuals in a group. Individualists prefer personal praise and independent work tasks to prove their competence. Collectivistic cultures (a low IDV), on the other hand, appreciate group tasks and decisions. They do not want to be exposed individually, and personal identity is defined by the group (Binder 2007). The third dimension *masculinity* (MAS) addresses the degree of gender differentiation in the respective country. Men are associated with attributes such as power, control, or ambition, while females are connected solely with modesty and quality of life. Roles may be clearly defined, such as that men reach senior management position whereas women are expected to bring up children (Mead 2005). In low masculinity cultures, both genders are valued equally and both may reach a senior management position. Achievement is measured based on human contact and, consequently, relationships matter (Binder 2007). *Uncertainty avoidance* (UAI) reflects the resistance to change and the willingness to take risks. Especially in setting up new business operations, as in the case of offshoring service projects, the level of risk is expected to be high. Accordingly, this dimension bears an impact comparable to the others. Employees whose uncertainty avoidance is high appreciate working with strict rules and control systems, including instruments that reduce the level of risk (Binder 2007). Finally, the fifth dimension is *long- versus short-term orientation* (LTO). Long-term-oriented cultures are labeled 'Confucian,' owing to the values attributed to the teachings of Confucius. Business relationships are ordered by status, and entrepreneurial activity is fostered according to this order. In contrast, short-term-oriented cultures are characterized by personal stability as exemplified by the protection of 'face' and the veneration of tradition. Here, immediate results are valued (Binder 2007).

In his research, Hofstede concluded that Germans have a low power distance result at 35 out of 100. Germans tend also to be individualists, scoring 67 out of 100, while demonstrating a rather high degree of masculinity at 66 out of 100. In addition, their uncertainty avoidance comes in high at 65 out of 100. In the fifth dimension, long- versus short-term orientation, Germans are found to have a short-term focus, scoring 31 out of 100 (Hofstede 2010).

13.2.3.1 Infrastructure and Legal Aspects

Even though sufficiently talented low-wage employees are available, they are becoming more decentralized. Local infrastructure requisites for a qualifying offshore location include sound telecommunication and IT networks, as measured by the speed of connection and degree of connectivity. In addition, availability and quality of real estate, the power supply, and transportation connection are important aspects (Kotlarsky et al. 2009). Among the infrastructural considerations, the most essential to the success of a service offshoring project is the telecommunication infrastructure. Moreover, the continuity of electrical power supply is an issue (Vashistha and Vashistha 2006). Owing to the importance of infrastructure, government officials in potential offshoring locations have laid substantial investment plans and made it a core strategic priority (Business Monitor International 2010). The Business Monitor International (2010) has also concluded that among all construction investments within the core emerging markets,[3] 45 % are allocated to building or improving infrastructure (p. 10). In order to assess the current strength and quality of the infrastructure, one needs to calculate an infrastructure-to-construction ratio. According to this calculation, China appears rather weak with a ratio of 40 %, especially compared to other potential offshoring countries such as Mexico (62 %), Brazil (55 %), Nigeria (55 %), Russia (53 %), and India (51 %) (Business Monitor International 2010, p. 12).

[3] According to Business Monitor International core emerging markets include Mexico, South Korea, Turkey, Vietnam, Poland, Hungary, South Africa, Nigeria, Russia, China, India, Brazil, and Indonesia.

13.2.4 Political Risk

In addition to the specific service offshoring location decision factors elaborated in the four previous subchapters, one should discuss one additional, conclusive offshoring decision factor in the analysis: political risk. This factor addresses the likelihood that a government will change their laws or regulations pertaining to business and commerce, including adherence to those of the World Trade Organization (WTO) or those protecting patents. Moreover, a government's effectiveness, the efficiency of its court system, and the enforcement of contracts are evaluated herein (Feinberg and Gupta 2009). The purpose being to quantify the risk of asset depreciation due to government-imposed impediments or even potential expropriation of the firm's investments (Feinberg and Gupta 2009). Consequently, offshoring firms need to first assess the respective country risk and then develop coping measures accordingly.

13.3 Data and Methods

13.3.1 Data Envelopment Analysis

We used data envelopment analysis (DEA) to compute the proposed comparative efficiency analysis (Cooper et al. 2007). A typical statistical approach would be to evaluate entities according to an average, that is, through a regression analysis and thereby conduct the individual performance of the research data. In order to measure the efficiency of a given data sample, however, it may be more useful to compare the entities with one other. Thus, the point of reference should not be a theoretical average, but the best possible market performer within the set of data. DEA is a good choice for this specific kind of research with a comparative efficiency analysis (Cooper et al. 2007). DEA constructs a practice frontier from the data in the research sample and moreover calculates the distance between the various samples, enabling a data comparison. The individual entities of the data set are labeled as decision-making units (DMUs). In our study, the DMUs are the respective countries; for instance, DMU 1 is Argentina and DMU 2 Austria. Overall, 27 DMUs are analyzed.

13.3.2 Research Models

We designed four separate models. Each of these models has the same DMUs which are 27 globally distributed countries. In addition, all models assume the same input factors. Five input factors have been selected based upon the literature review: (1) wages, (2) education, (3) cultural distance, (4) infrastructure, and (5) corruption. Notwithstanding the same input factors, the output measures are different. Model A measures the amount of offshoring activities within the respective host country initiated by German service firms, while Model B captures the value creation of service activities within the host country. Value creation is measured by the quantity of service exports from the host country to the world, incorporating both the measure of commercial as well as computer and communication service exports. The latter is, in fact, a subset of the commercial service exports. Model B combines both service export measures as the output, while Model C and Model D consider the commercial and the computer and communication service exports individually.

13.3.2.1 Input Measures

The initial factor identified was cost reduction through lower wages in host countries. In order to identify a country's wage level, we utilized wage data research conducted by UBS in 2008, which reflects wage data from the previous 3 years. This particular data set was chosen because it indicates gross wages that are the actual expenses for offshoring firms. Net wage data would only deliver vital information for the employee, not for the employer (Bunyaratavej et al. 2008). Service offshoring firms are interested in the wage levels at potential offshoring sites and not in the country average. Therefore, wage information based on research of major cities reflects actual expenses more accurately. UBS typically collected the gross wage data of one major city per country. Also, the presented wage data are based on a basket with a scope of 14 professions (UBS 2009).

As concluded by prior research, the quality of local education is a significant factor in the increased demand for services. The number of pupils enrolled in secondary education was considered in order to proxy this information, revealing the number of educated potential employees to join the workforce in subsequent years (Bunyaratavej et al. 2008). Thus, it is concluded that the more pupils enrolled in secondary education, the greater the educated workforce in the respective host country. In order to retrieve these data, we used the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics database. Data included the total enrollment in private as well as public secondary education for the year 2007 (UNESCO 2010).

The third input factor was the cultural distance between the home country (Germany) and the host country. As earlier presented, the difference in Hofstede dimensions may lead to increased challenges in doing business in a foreign country. The closer a host country is to the home country, in terms of culture, the less likely it is that there will be cultural conflicts. Gupta and Raval (1999) even propose that cultural conflicts have the potential to 'make or break an offshoring project' (p. 24). Cultural distance, as the third input factor, was therefore the absolute mean difference in Hofstede's dimensions for Germany and the prospective host country. A cultural distance index (CDI) was calculated. Specifically, the CDI was calculated as follows:

$$\mathrm{CDI} = \frac{1}{K}\sum_{k=1}^{K}\left|H_k^{\mathrm{Host}} - H_k^{\mathrm{Home}}\right|$$

where H represents the cultural score on the respective dimension whereas k indexes the dimension itself. K is the sum of all dimensions, thus K equals 4 or 5 depending on the availability of the LTO score of the respective host country. A decrease in CDI score implies cultural similarity, whereas an increase indicates greater cultural distance (Bunyaratavej et al. 2008).

The fourth input factor was infrastructure. Advanced telecommunication networks and IT infrastructure are necessary preconditions for a host country to qualify as an offshoring site, especially in the case of a service offshoring project (Rao 2004). Since the host country's government is the institution responsible for establishing such a qualifying infrastructure, the World Development Indicator, labeled as *information and communication technology expenditure*, was considered a quantifiable measure. The indicator includes spending on computer software and hardware, communication services, as well as wireless communication equipment. The 2007 data were presented in US dollar value[4] (World Bank I 2010a).

The fifth input factor aimed to capture the political environment, particularly corruption. The lower the political risk, the more attractive the location due to the fact that the offshoring firm's operations are not diminished. The less corruption that exists, the more attractive the location is. In measuring the degree of corruption as an input factor for the following DEA, we used the analysis of the *Corruption Perception Index* (CPI) computed by Transparency International for the year 2007 (Transparency International 2010). This index measures the perceived level of public-sector corruption around the world based on thirteen different business and expert surveys. Countries were ranked on a scale of 0 to 10, with 0 being perceived highly corrupt and 10 as having low levels of corruption.

13.3.2.2 Output Measures

As presented above, the following DEA consisted of four models, namely Models A, B, C, and D, each of which incorporated different output measures.

Model A measures the quantity of offshoring investments to a specific country from Germany. This appears to be a valid measurement of a location's attractiveness for two main reasons. First, companies tend to follow one another to offshoring locations based on a location's track record (Farrell et al. 2006). Also, learning opportunities from previously offshored firms can be utilized to reduce potential challenges. Second, a country's ability to attract firms proves it is an attractive location. The greater its investment in an offshoring location, the more

[4] The exchange rate of the 8th of June 2010 has been utilized to convert the figures to euros (0, 8384 USD/EUR).

attractive the country becomes (Bunyaratavej et al. 2008). To capture German investments within the various offshoring locations, we used the *Eurostat* database compiled by the European Commission (2010). German direct foreign-service investments from the year 2007 were considered. Nevertheless, the service FDI may measure solely the activities within a location, inferring attractive locations from that; it may not, however, indicate whether a location is actually able to create value. Therefore, we felt the need to develop a second measure that captures value creation.

Model B incorporates two output factors, which both have an export orientation. The underlying premise for the two output factors is that a firm's overall offshoring objective is to complete a value-added service. Thus, it is a question of whether a location is able to create value with its services. The higher the probability that a location's environment is able to lead to value creation, the more attractive the location will be from a service offshoring firm perspective (Bunyaratavej et al. 2008). The quantity of service exports were used to assess service value creation in various countries. The first indication of output is *commercial service exports,* which the World Bank measures for its assessments. This indicator captures total service exports minus government services while defining services as the economic output of intangible commodities that may be produced, transferred, and consumed at the same time (World Bank II 2010b). The second output measure of Model B follows the same line of reasoning as the first. However, since the term 'commercial service exports' is rather broad, the second measure captures solely *computer, communication, and other service exports*. By this measure, the validity of Model B grows as nations like Germany increasingly offshore these services. As computer and communication service exports are a subset of commercial service exports, Model B counts computer and communication service exports doubly, thereby endowing them with additional importance (Bunyaratavej et al. 2008). Data for 2007 computer and service exports are employed and listed as a percentage of the World Bank indicator of commercial service exports[5] (World Bank II 2010b). Models C and D assess the two service value creation measures individually, with Model C exploring commercial service exports and Model D computer, communication, and other service exports.

13.4 Findings from DEA

The four models were run using all five input factors. In considering Model A, the three countries attain the maximum (100 %) score were the Netherlands, the United Kingdom (UK), and the US. Model B concluded that Belgium, Hong Kong,

[5] Commercial service exports as well as computer, communications, and other service exports are initiated by the World Bank in US dollars. For the use of the following DEA, these values are converted to euros using the exchange rate of the 8th of June 2010 (0, 8384 USD/EUR).

India, Sweden, and Switzerland are also 100 % efficient. Model C adds Denmark with 100 % efficiency. Model D does not add any other 100 % efficient locations. Table 13.1[6] below provides the efficiency scores for all countries and all models. The efficiency scores of Norway and Denmark cannot be provided, due to the lack of data available.

In regarding Models A to D, respectively, we propose that the higher the efficiency score, the more attractive the investment in that specific offshoring location. Thus, the question arises of whether the two variables, the respective efficiency score of Models A to D from Table 13.1 above and the respective outputs, positively correlate German service FDI investment and service exports. This additional analysis enables us to confirm the robustness of the DEA findings, while validating actual location attractiveness. The expectation of positive correlation implies that the computed efficiency score is in accordance with the attractiveness of the location. In order to test this proposition, the Pearson correlation coefficient r is utilized. General guidelines for the interpretation of the resulting magnitude are as follows: small correlation with $|r| = 0.20 - 0.29$, medium with $|r| = 0.30 - 0.49$, and large with $|r| = 0.50 - 1.00$ (Cunningham et al. 2010). In calculating the Pearson correlation coefficient, the program SPSS Statistics 17.0 is utilized.

The input factors for the calculation are the efficiency scores and the respective considered output variable. Computing the first correlation for Model A, a large correlation results with a Pearson correlation coefficient of 0.908 (with an alpha of 0.01) corroborating the prediction: A higher location efficiency leads to higher service FDI investments from Germany in the respective location. The second correlation with Model B also leads to a large Pearson correlation of 0.517 (with an alpha of 0.01). It may be concluded that the higher location efficiency also leads to greater service value creation, increasing the location's attractiveness. Models C and D, which analyze Model B in more detail by considering the two output factors individually, are thus also expected to support the prediction. Model C yields 0.486, with an alpha of 0.05, while Model D concludes 0.572 with an alpha of 0.01. Both correlation coefficients demonstrate a strong relationship between a location's efficiency and value creation through service activities and hence support our prediction.

In order to identify latent structures and create a typology within the given data set of 27 countries, a k-means cluster analysis is performed at this point. The scores of Models C and D are neglected at this point due to the fact that they explore Model B in detail and do not incorporate new data. For the given data set, five clusters have been identified with significant mean differences, as shown

[6] All four models ranging from A to D utilized exactly the same five input factors, namely hourly wage costs, infrastructure investments, secondary education enrollment, cultural distance, and corruption perception. For the output measure Model A applies service FDI investment in the respective host country, Model B utilizes commercial service exports as well as information and communication service exports, while Model C and D consider these two exports measures, respectively, on their own.

Table 13.1 DEA results

Country	Model A	Model B	Model C	Model D
Argentina	0.019	0.255	0.253	0.249
Australia	0.081	0.432	0.432	0.222
Austria	0.499	0.917	0.917	0.758
Belgium	0.292	1.000	1.000	1.000
Brazil	0.071	0.220	0.198	0.220
Canada	0.067	0.428	0.401	0.428
China	0.306	0.961	0.961	0.655
Czech Republic	0.141	0.408	0.408	0.283
France	0.366	0.594	0.594	0.486
Hong Kong	0.096	1.000	1.000	1.000
India	0.171	1.000	1.000	1.000
Italy	0.268	0.603	0.603	0.544
Japan	0.030	0.487	0.407	0.487
Mexico	0.089	0.412	0.412	0.039
The Netherlands	1.000	1.000	0.907	1.000
Poland	0.293	0.450	0.450	0.381
Portugal	0.070	0.385	0.385	0.291
Russia	0.244	0.397	0.397	0.361
South Africa	0.039	0.243	0.243	0.081
Spain	0.175	0.900	0.900	0.657
Sweden	0.218	1.000	0.934	1.000
Switzerland	0.722	1.000	1.000	1.000
Turkey	0.066	0.412	0.412	0.104
UK	1.000	1.000	1.000	1.000
US	1.000	1.000	1.000	1.000

below. The means are given as cluster center (CC). The CCs represent the mean efficiency of the countries within the respective cluster ID and range from 0.9653, for the most efficient Cluster 1, to 0.2271 for the least efficient Cluster 5 (Table 13.2).

Cluster 1 includes those countries that are highly efficient with respect to both output measures and the amount of service investment, as well as the value creation through these services. It may, furthermore, be noted that only developed, Western nations are included. Worth noting is the Netherlands score, valued to be 90 % efficient with respect to service exports overall from Model C; however, according to Model D which considers solely information and computer service exports, it is 100 % efficient. Hence, the Netherlands is especially efficient at creating value with these particular services. The second cluster countries tend to be highly efficient in terms of their service exports, each above 90 %. Austria, with an efficiency of 76 %, is far less efficient when information and computer service exports are considered individually. However, Cluster 2 service FDI investments are less efficient with scores ranging from 50 to about 30 %. The majority of the member countries of this cluster are again European nations, with the exception of

Table 13.2 Aggregated k-means cluster analysis

Cluster ID				
1 CC = 0.9653	2 CC = 0.6625	3 CC = 0.57	4 CC = 0.429	5 CC = 2271
The Netherlands	Austria	Hong Kong	France	Argentina
Switzerland	Belgium	India	Italy	Australia
UK	China	Spain	Poland	Brazil
US		Sweden		Canada
				Czech Republic
				Japan
				Mexico
				Portugal
				Russia
				South Africa
				Turkey

China. The third cluster is also highly competitive in terms of service exports efficiency. All countries achieved a 100 % efficiency score, except Spain (90 %). Spain, with only 66 % efficiency, also falls behind considerably in information service exports. Furthermore, all countries lack in attracting a high level of service FDI. The best performing country, with respect to this measure, is Sweden with 22 % efficiency; the others are lagging far behind. These countries face the same challenges as do those from the second cluster, namely in converting their service value creation into investments from Germany. The fourth cluster countries have a medium score on service exports and a medium score on attracting German service FDI investments. The fifth cluster countries have a low efficiency score in both the service FDI investments and the service exports dimensions. Fifth cluster members are South American countries (Argentina and Brazil), developed economies (Portugal and Japan), and the developing nations of South Africa, the Czech Republic, and Russia.

A next step is to investigate the source of overall efficiency. This analysis is of great importance for two reasons. First, firms become aware of the individual location strength and, thus, may weight the criteria according to their respective main objective. By simply considering the overall DEA above, individual aspects cannot be extracted. The second objective of this input analysis is to create awareness for countries' governments. Knowing the individual efficiency, the opportunity arises to increase it, using certain macroeconomic measures.

13.4.1 Input-Specific DEA

Our second prediction was that the higher the individual input efficiency of a country, the more attractive the offshoring investment becomes, solely on the basis of this specific input. In order to test this, five Pearson correlation coefficients were calculated, one for each input factor. We utilized the service export of Model B as the output correlation measure.

First, wages were tested. A positive relationship is expected between the wage efficiency and amount of service exports, implying that the higher the wage efficiency of a location, the higher the number of service exports, which increase the location's attractiveness. A correlation of 0.394 with an alpha of 0.05 results, which represents a positive, medium correlation; thus, our second prediction was also supported. The cultural distance and the CPI also propose a positive correlation, implying that the more efficient the cultural distance and political environment, the higher a location's attractiveness. The Pearson correlation is 0.906 for CDI and 0.810 for CPI, both with an alpha of 0.01. For both parameters, a strong positive correlation may be concluded. For the next factor—the quantity of education enrollment—an r of 0.055 results. A positive yet small correlation is supposed to exist. However, to derive this correlation, an alpha of 0.789 is utilized, which is above the maximum acceptance level of 0.05; therefore, our second prediction is not supported for the education input factor. A similar result yields the infrastructure investments input factor; which also requires a positive correlation to reinforce the proposition. Yet an r of negative 0.032 is yielded with an alpha of 0.875 which is far above the assumable alpha of 0.05. Consequently, the infrastructure input factor does not corroborate our second prediction. On the whole, we find support for three out of five parameters; for the remaining two; no correlation was found.

Table 13.3[7] depicts the five individual input measures ranging from wages to corruption perception index. Accordingly, five CCR DEAs were conducted with respect to individual input measures, utilizing the service export volume measure from Model B as the output variable. For instance, the scores in the first column labeled as *wage* are calculated by considering the wage data (UBS 2009) as the input variable and the *commercial service export* volume as well as the *computer, communication, and other service exports* (World Bank II 2010b) as the output measure, *ceteris paribus*. As an example, Argentina is 4.6 % efficient with respect to the input factor wages, all other inputs being equal. The ideal offshoring location would be a combination of the 100 % scores on the individual efficiencies, namely wage efficiency from India, infrastructure and education efficiency from Hong Kong, CDI efficiency from the US, and CPI efficiency from the UK.

[7] Wage efficiency scores are conducted by utilizing wage data issued by UBS (UBS 2009, p. 26). Infrastructure scores are calculated by conducting information and communication expenditures issued by the World Bank. (World Bank I 2010a) For education efficiency, the number of pupils enrolled in secondary education is applied issued by UNESCO (UNESCO 2010) while cultural distance efficiency scores are based on Hofstede's cultural dimensions research. (Hofstede 2010) Political environment efficiency scores are calculated by using the corruption perception index computed by Transparency International (Transparency International 2010).

Table 13.3 Input-specific DEA

Country	Wage	Infrastructure	Education	CDI	CPI
Argentina	0.046	0.188	0.019	0.018	0.008
Australia	0.039	0.191	0.096	0.099	0.162
Austria	0.052	0.571	0.417	0.091	0.161
Belgium	0.061	0.857	0.655	0.086	0.149
Brazil	0.064	0.103	0.008	0.025	0.024
Canada	0.068	0.197	0.184	0.112	0.299
China	0.613	0.141	0.008	0.068	0.104
Czech Republic	0.047	0.271	0.109	0.032	0.020
France	0.150	0.242	0.151	0.169	0.315
Hong Kong	0.175	1.000	1.000	0.052	0.284
India	1.000	0.804	0.010	0.122	0.118
Italy	0.152	0.251	0.157	0.267	0.131
Japan	0.119	0.138	0.146	0.118	0.348
Mexico	0.152	0.085	0.010	0.016	0.015
The Netherlands	0.083	0.606	0.572	0.140	0.661
Norway	0.030	0.629	0.595	0.051	0.177
Poland	0.093	0.270	0.054	0.038	0.028
Portugal	0.036	0.385	0.205	0.015	0.038
Russia	0.102	0.198	0.024	0.031	0.029
South Africa	0.037	0.116	0.017	0.035	0.016
Spain	0.160	0.417	0.249	0.140	0.220
Sweden	0.059	0.855	0.777	0.087	0.676
Switzerland	0.038	0.449	0.654	0.454	0.366
Turkey	0.089	0.253	0.025	0.025	0.027
UK	0.282	0.451	0.377	0.555	1.000
US	0.376	0.130	0.139	1.000	0.981

13.4.1.1 Efficiency Sources of Cluster 1 Countries

Switzerland is the third most efficient country with respect to cultural difference, at 45 % efficiency. Owing to its closeness in culture, there is great service offshoring. One of the main CDI reducing factors in the case of Switzerland is the fact that Germany and Switzerland share the same language. Since services may involve close customer contact, language is a highly valuable factor and provides opportunities other non-German-speaking countries do not have. Besides, Switzerland has a 65 % efficiency score in education. In terms of absolute numbers, approximately 600,000 pupils are enrolled in secondary education which is, in considering the 27 countries, the fourth lowest quantity. However, due to the huge number of service exports, Switzerland is highly efficient with its small labor pool. It may further be inferred that the dearth of educated employees creates intense competition, leading to higher wage costs. Switzerland is only 4 % efficient in considering wages. In absolute terms, Switzerland is the second most expensive country in the data sample with average hourly costs of 23 Euros. Moreover, Switzerland, with a score of 37 %, has the lowest CPI efficiency in Cluster 1. On the whole, Switzerland is especially competitive in regard to education and cultural distance.

In addition, the UK is included in Cluster 1 with an overall efficiency of 100 % in Models A, B, C, and D. Generally speaking, the UK may be categorized, along with the US or Switzerland, as a high-cost country. However, owing to its overall highly efficient business environment, service exports of 240 billion Euros lead to a wage efficiency of 28 %. By contrast, the US, despite having a larger economy, has only twice the number of exports of the UK. Education in the UK, at 38 %, may be valued as 'medium efficient.' Moreover, the UK receives the highest CPI score of 100 %, followed by the US with 98 %. The other input variables score above average, yet do not attain 100 %. On the whole, the UK is particularly strong in regard to its political environment and, thus, qualifies for those service firms concerned with data protection and an overall need of efficient factors.

The US, with a score of 98 %, turns out to be 100 % efficient on CDI and also highly efficient for CPI. Germany and the US score nearly equal on power distance, masculinity, as well as long-term orientation. Therefore, the same leadership styles or motivation techniques may be applied within internal operation, which reduces the effort required in developing operations. Also, despite the different languages, no cultural conflicts can be expected. Although the absolute CPI score is below that of Sweden and the Netherlands, which are the highest in the data set, the US qualifies as a stable political environment. This conclusion is supported by the tremendous amount of service FDI leading to nearly 100 % efficiency. Wage costs are the second most expensive in Cluster 1 and the third most expensive overall after Switzerland and Denmark. Yet, wage efficiency is the highest in Cluster 1, with 35 % efficiency. Thus, labor is expensive, but efficient. Furthermore, the US has the highest incidence of secondary school enrollment after China and India. However, measured in reference to the amount of service exports as the value indicator, the US is only 14 % efficient; the weakest country in Cluster 1 with respect to education. The last input variable, the infrastructure investment, is 13 % efficient; although in absolute terms, the investments are far above the other countries. To sum up, the close culture and stable political environment turn out to be costly. The other input variables appear to be weak, owing to the relatively low amount of service exports.

The Netherlands is the last country of Cluster 1, with an overall efficiency of 100 % in Models A, B, and D, and 91 % in Model C. The main efficiency sources are the infrastructure investments and political environment with single efficiency scores of 61 and 66 %, respectively. The cultural distance is the second greatest of Cluster 1 countries, leading to an efficiency of 14 %. The Netherlands is characterized as a feminine culture, while Germany is a highly masculine one which leads to different job designs as well as customer handling. The CPI, with an efficiency of 66 %, is the third highest score in the Cluster 1 countries. This is supported by two indications. First, the absolute CPI score is relatively high at 9 out of 10. Second, the political environment is appreciated and supported with substantial service FDI from Germany. In 2007, the Netherlands was the country with the highest German service FDI of 116 million Euros. Wage costs are sharply above those of the UK, yet the efficiency is far lower at solely 8.6 %, as compared to the 28 % of the UK. This may be attributed to the three times fewer service exports compared to the UK. To conclude, the Netherlands is strong on each measurement except culture and wages.

13.4.1.2 Further Remarkable Aspects Revealed by the DEA

Clusters 2 and 3 incorporate two main offshoring locations, namely India and China. Considering the overall efficiency analysis, both are highly efficient according to Models B and C, China scoring 96 % while India scores 100. India also scores 100 % in Model D, while China lacks in communication and computer service exports leading to an efficiency of 65 %. In Model A, China scores only 31 %, while India scores 17 %. Both locations are particularly strong on wages. India is the cheapest location within the sample and owing to substantial service exports, reaches a wage efficiency of 100 %; thus, setting the benchmark for all other countries researched. The efficient frontier generated outperforms most other offshoring locations by a large degree, and most of the countries, therefore, appear to be highly inefficient—17 countries are below 15 % efficiency. Nonetheless, China turns out to be the second most efficient country with respect to wages with an efficiency score of 61 %. Putting this wage aspect in the context of education, it appears that China and India do not produce as many efficient workers as the Cluster 1 countries, discussed above. The education efficiency for both locations is approximately 1 %. This inefficiency may be best exemplified by calculating the per-educated worker output, given the service output applied within this research. In India, each potential educated employee generates an output of 895 Euros, in China 1,210 Euros. In contrast, Cluster 1 countries such as the US, the Netherlands, and Switzerland are able to attain an output per-educated worker of 17,598 Euros, 58,960 Euros, and 106,870 Euros, respectively.[8] Thus, it may be inferred that firms with extreme cost considerations may be attracted to China and India; however, cost savings are generated at the expense of quality. When discussing the role of China as a service offshoring location, additional attention has to be placed upon Hong Kong. Hong Kong, being a major Chinese city, is far more expensive than the average major Chinese offshoring location. Therefore, the wage efficiency decreases to only 17.5 %. However, higher wages may be justified by exploring the education efficiency which is 100 %. Hong Kong is able to generate the highest per-worker output within the research sample. Of additional disadvantage to China and India are their unstable political environments. Absolute CPI scores of 3.4 in China and 3.4 in India lead to an efficiency of 10.5 and 11.8 %, respectively. Despite the low scores, their efficiency may still be valued as moderate. Both locations have sufficient service exports and thereby enhanced their score. Other

[8] For the output per-educated employee calculations, the ratio of the *commercial service exports* (World Bank II 2010b) and *enrollment in secondary education* (UNESCO 2010) is utilized.

locations with a comparable CPI score such as Mexico with 3.4 reach an efficiency of only 1.5 % due to the fact that it lacks in creating value through exports and thereby fails to balance its rating. The last measure, infrastructure, appears to be one of the key advantages in India with an efficiency of over 80 %, which is the fourth highest rate overall. In contrast, China is 14 % efficient. Even though China invested five times as much as India with an absolute sum of 186 billion Euros, the resulting service exports are marginally higher than India's. Yet, in considering Hong Kong, the advantages of major hubs are demonstrated once again. Hong Kong reaches 100 % efficiency on infrastructure investments, due owing to the fact that 7 % of all investment in China was allocated to Hong Kong.

Another developing nation, Russia, shall be mentioned briefly. Russia is allocated to the least efficient Cluster 5 with an efficiency of 24 % in Model A and 40 % in the remaining models. Russia's main advantage is, as with India and China, wage and infrastructure efficiency. However, Russia is not able to reach as high as efficiency score, with 10 % for wages and 20 % for infrastructure. In absolute terms, the wages of Russia are still double those of China while the service exports are far below those of the other countries researched; Russia is ranked the location with the seventh lowest number of service exports. Considering the other measures, education efficiency is 2.4 %, which is above the score of India and China, yet still highly inefficient. In addition, the unstable political environment demonstrates great challenges for Russia. The absolute CPI score of 2.3 out of 10 is the worst score among the researched countries which leads to an efficiency of 2.9 %. On the whole, Russia does not demonstrate any location advantages, due to the fact that it is outperformed on every input measure.

Extant literature has extensively discussed the emerging role of EE for German firms seeking offshoring (Dalia 2006). However, this role has developed from multiple earlier manufacturing offshoring projects, in particular in the automotive sector (Hall and Hussey 2007). It is further argued, that more advanced service functions have already partially moved and will continue to move to these locations (Safar 2006). Thus, the question arises whether EE has already completed this transition process from manufacturing to services. As of 2007, EE still lags far behind with its service offshoring efficiency. EE, in this study represented by Poland and the Czech Republic, is included in Clusters 4 and 5. The main drawback of these two locations lies in their political environment, with an absolute CPI score of 5.2 in the Czech Republic and 4.2 in Poland, which leads to 2 and 2.8 %, in terms of efficiency. Poland, which is twice the size of the Czech Republic in terms of its gross domestic product (GDP) (UNESCO 2010), has nearly double the service exports of the Czech Republic; thereby creating a slightly higher efficiency. In terms of wages, EE is more efficient than most of the Cluster 2 countries, with an efficiency of 10 % in Poland and 5 % in the Czech Republic; nevertheless, it is not able to attain such a high-wage efficiency as other low-cost locations such as China and India. Education levels, the counterpoint to wages, do, however, appear far below those of Cluster 2. The same can be concluded for the cultural distance, which for both locations are below 4 % efficiency. It should be noted that Poland and the Czech Republic are very similar in regard to their Hofstede dimension, and differ from Germany solely in their PDI and UAI scores (Hofstede 2010). These weak scores notwithstanding, infrastructure investments appreciate EE's efficiency score to 30 % efficient in both locations. Thus, it may be inferred that an infrastructural base is established upon which potential service offshoring firms may build in the future. Yet, other measures need to be taken to fully increase their attractiveness to service firms.

13.5 Conclusion

We conclude that the most efficient service offshoring countries for German firms are the Netherlands, Switzerland, the UK, and the US, with an average efficiency of 97 %. To identify the efficiency sources in a second instance, five additional DEAs were performed, considering each input factor individually. That the results show that, with respect to wages, India is 100 % efficient; considering education and infrastructure, Hong Kong is 100 % efficient; for cultural distance, the US is 100 %; and in considering corruption, the UK leads with an efficiency of 100 %. Furthermore, our research concluded that developing nations are more efficient with respect to wages as well as infrastructure. The developed nations, on the other hand, appear to have the competitive edge in education of their workforce and stable political environment. A positive correlation was proven to exist between a location's attractiveness and its efficiency score, implying that a higher efficiency leads to a higher attractiveness.

To conclude, this research made contributions on micro as well as macro level. To derive the best possible location choices, the identified efficiency scores have to be put in the context of functions. Therefore, the main offshoring functions have been discussed. For IT related services, education and wage considerations are dominant aspects. In considering a location's IT focus in addition to the aforementioned factors, Hong Kong and India prove to be the best possible offshore locations. In choosing between two countries, the determinants are efficiency and specialization. Hong Kong is both more expensive and less specialized in IT, but has highly efficient workers. Meanwhile, India is the cheaper location with high IT specialization, but its employees are not as efficient. The next industry analyzed is telecommunication. Here, wage considerations in combination with a stable political environment to ensure critical data protection are overriding considerations. The discussion concludes that India and the US are the most suitable locations. Moreover, the role of call centers has been explored. Here, the research has to be extended by cultural distance, due to intense customer interaction. Leading to the conclusion that nearshore locations with low wages are the most efficient. In this context, the UK and Italy turn to be highly efficient. EE may serve as a future high-potential location if firms are able to diminish negative cultural effects. As a final function, R&D is explored. Here, education efficiency and data protection are significant, pointing to UK, Hong Kong, and India locations. Again, higher wages in the UK are justified by a more efficient political environment.

At the macro level, we identify how likely governments are to increase their location's efficiency scores. The probability of the individual input factors has been discussed, and it may be concluded that since developing countries turn out to be more efficient in their wages and infrastructure, they are far more likely to increase their score with respect to these measures. Developed nations, on the other hand, have a competitive edge in their efficient workforce and stable political system and therefore may extend their score with regard to these factors.

We advance the findings by Bunyaratavej et al. (2008), which utilized the US as the home country, by comparing location efficiencies for Germany as the home country. We conclude that a general adaptation of efficiency scores is not possible. Even if overall efficiencies are found to be partially similar, the efficiency sources are still varied, which leads to different implications. Nevertheless, it appears that psychical proximity shapes the efficiency of locations. Most European countries were more efficient for Germany while those close to the US, such as Argentina or Canada turned out to be more efficient for US-based firms. Yet this finding may not be universally valid as demonstrated by results of EE. In any case, additional location efficiency research needs to consider the home countries individually in order to spot efficiencies.

One of the limitations of our study is that DEA examines a one-year snapshot. Hence, by updating the completed analysis on an annual basis, one can track the way nations shape their factors, thereby increasing their efficiency over time. This would also consider long-term developments, which are partially influenced by the input factors. Infrastructure investments, for instance, have a long-term focus, which still may not be considered in the respective one-year perspective. To further the practical relevance of the research, we suggest two additional aspects. Measurement of the political environment, or the corruption perception index, can be exchanged for a broader measure that focuses not only on corruption, but also on the whole political system.

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