

The Development Trend of the Chinese and U.S. Construction Industries

Yilei Huang and Yong Bai, Ph.D., P.E.

University of Kansas
Lawrence, KS

To assist U.S. architectural, engineering, and construction (AEC) firms in conducting business in the Chinese market, a comprehensive comparison of the development trend of the Chinese and U.S. construction industries from 1978 to 2008 was conducted and adjusted for inflation. The growth trends of value added and Gross Output Value of the Chinese and U.S. construction industries were analyzed and compared. In addition, future growth of value added and Gross Output Value of the two construction industries were projected using polynomial functions and exponential functions. The results show that the Chinese construction industry grew at higher and more stable rates than the U.S. construction industry, and is projected to surpass the latter in the near future. The findings of the research can help the U.S. AEC firms become more familiar with the Chinese construction industry through its growth pattern.

Key Words: China, Construction Industry, Value Added, Gross Output Value, Projection

Introduction

In recent years, China has experienced huge economic growth. According to The World Factbook 2009, China stood as the second largest economy in the world measured by purchasing power parity and was the third largest measured by the official exchange rate. An important segment of the national economy, the construction industry increased greatly. From 2001 to 2008, the Gross Output Value of the Chinese construction industry had an average growth rate of 22.2%. During the same period, the number of construction firms in China increased by 54.9%, and the number of workers employed by Chinese construction firms increased by 57.1%.

Despite China's huge progress in its national economy and construction industry, many scholars still considered the Chinese construction industry a weak sector by international standards (Xu et al., 2005). After China's entry into the World Trade Organization (WTO) on December 11, 2001, it was moving toward a more open and market-driven economy. Although many regulations with constraints on foreign participation were abolished or modified, the influence of foreign funded construction firms on the overall Chinese construction market is still small, and restrictions on project types undertaken by wholly foreign owned firms still exist.

To assist the U.S. AEC firms to become more familiar with the Chinese construction market, a comprehensive comparison between the Chinese and U.S. construction industries needs to be conducted. The objectives of this research were to conduct a comprehensive comparison between the development of the Chinese and U.S. construction industries, analyze the development trends of their economic indicators, and project their future growth. The timeline of the comparative study is from 1978 (after the Chinese Culture Revolution) to 2008.

Literature Review

China has been adopting an open-door policy for attracting foreign investment since 1979. However, construction industry reform was not announced until October 1992 (Mayo and Liu, 1995). From 1979 to 1991, the Chinese government assigned projects to contractors, provided all finances for construction activities, and had dominant control over the construction market (Shen et al., 2004). After construction industry reform started in 1992, the Chinese construction legal system was gradually developed, and the two most important laws, the Construction Law and the Bidding and Tendering Law, were enacted in 1997 and 1999, respectively (Lam and Chen, 2004). In 1995 the number of contract bids increased to 34.5% and it became a legal requirement to award all public contracts through bidding procedures (Shen et al., 2004). After being formally admitted to the WTO in December 2001, China honored its commitments to liberalize the construction market, and laws and regulations with constraints on foreign participation were abolished or modified (Xu et al., 2005).

On the other hand, the U.S. construction industry is one of the largest industries in the United States when one includes construction-related businesses involving design, new construction, renovation construction, equipment and materials manufacturing, and supply, making it account for 13% of the U.S. Gross Domestic Product (GDP) (Goodrum and Gangwar, 2004; Allmon et al., 2000). The U.S. construction industry employed about 5.2% of the national workforce with over 10 million employees, and was projected to be the only goods-producing industry with employment growth through 2012 (U.S. Department of Labor, 2004; Allmon et al., 2000). The industry has experienced a sustained long-term increase in output, and the demand for both residential and nonresidential construction is expected to continue to rise as baby boomers reach their peak earning years with the ability to spend more on housing, the echo boomers (the children of the baby boomers) start to look for starter homes, and a large number of industrial structures will have to be replaced or remodeled (Goodrum and Gangwar, 2004; U.S. Department of Labor, 2004). Also, construction of extended care facilities will increase due to the aging of the population, and construction of schools will increase to accommodate the children of the echo boom generation (U.S. Department of Labor, 2004). There were many previous studies that analyzed the Chinese and U.S. construction industries independently. However, a comparison study of these two industries has not been conducted.

Methodology

Data Collection

Data used in this research include two sources: data on the Chinese construction industry from 1978 to 2008 and data on the U.S. construction industry from 1978 to 2008. Data on the Chinese construction industry were obtained from the China Statistical Yearbooks 1996 through 2009; data on the U.S. construction industry were obtained from the Bureau of Economic Analysis, U.S. Department of Commerce. These two datasets include value added of construction and Gross Output Value of construction. Value added of construction refers to the final result of the activities of production and operation of firms of the construction industry in monetary terms during a certain period of time; Gross Output Value of construction refers to the total of construction products and services, expressed in monetary terms, produced or rendered by construction and installation firms during the given period of time. Since the Chinese yuan and U.S. dollar had different inflation rates, inflation was considered for Chinese yuan and U.S. dollar, respectively, to convert the values in both currencies in each year to the equivalent values in 2008. The conversion can avoid the influence of the devaluation of currencies in both countries while keeping their buying power unchanged. Inflation rates of the Chinese yuan from 1980 to 2008 were obtained from World Economic Outlook 2010, International Monetary Fund; inflation rates of the U.S. dollar from 1979 to 2008 were obtained from the Bureau of Labor Statistics, U.S. Department of Labor.

Data Analysis

Data analysis was divided into three steps: the conversion of the values in Chinese yuan and U.S. dollar in each year to the equivalent values in 2008 by applying buying power factors, the comparison of the development trend of the Chinese and U.S. construction industries, and the projection of future development of the Chinese and U.S. construction industries.

In the first step, inflation rates were converted to buying power factors, which describe how many U.S. dollars in 2008 had the same buying power as one dollar, for example, in 1978. Buying power factors were calculated using the formula

$$F_{T+t} = F_T (1+f)^t$$

where f = inflation rate of the base year, F_T = buying power factor of the base year, t = the number of years ($t=1$ in this study since inflation rates varied in each year), F_{T+t} = buying power factor of the previous year (Eschenbach, 2003).

The buying power factor in 2008 was selected as 1.00 for the convenience of calculation, and the buying power factor in each previous year was then calculated. Table 1 shows the buying power factors of Chinese yuan and U.S. dollar from 1978 to 2008. Value added and Gross Output Value of the Chinese and U.S. construction industries in each year were then multiplied by their corresponding buying power factors for the following data analyses.

In the second step, the growth trends of value added and Gross Output Value of the two industries from 1978 to 2008 were compared. The currency unit used in the comparison was the U.S. dollar at the purchasing power parity (PPP) conversion factor of one U.S. dollar equaling to 3.6 Chinese yuan. The reason for using the PPP conversion factor instead of the official (bank) exchange rate in the comparison is that although the official exchange rate reflects at best the relative prices of tradable goods, the volume of goods and services that a U.S. dollar buys in the United States does not correspond to what a U.S. dollar converted to Chinese yuan at the official exchange rate would buy in China. The PPP conversion factor reflects differences in price levels for both tradable and nontradable goods and services and, therefore, provides a more meaningful comparison of real output (The World Bank, 2009). In the third step, the years when value added and Gross Output Value of the Chinese construction industry will surpass those of the U.S. construction industry were projected. The currency unit used in the projection was the U.S. dollar at both the official exchange rate of one U.S. dollar equaling to 6.85 Chinese yuan and the PPP conversion factor of one U.S. dollar equaling to 3.6 Chinese yuan.

Table 1

Buying Power Factors of Chinese Yuan and U.S. Dollar

Year	¥	\$	Year	¥	\$	Year	¥	\$	Year	¥	\$
1978	-	3.30	1986	3.74	1.96	1994	1.54	1.45	2002	1.21	1.20
1979	5.03	2.97	1987	3.49	1.90	1995	1.32	1.41	2003	1.19	1.17
1980	4.75	2.61	1988	2.94	1.82	1996	1.22	1.37	2004	1.15	1.14
1981	4.64	2.37	1989	2.49	1.74	1997	1.18	1.34	2005	1.13	1.10
1982	4.55	2.23	1990	2.41	1.65	1998	1.19	1.32	2006	1.11	1.07
1983	4.48	2.16	1991	2.34	1.58	1999	1.21	1.29	2007	1.06	1.04
1984	4.36	2.07	1992	2.19	1.53	2000	1.20	1.25	2008	1.00	1.00
1985	3.99	2.00	1993	1.91	1.49	2001	1.20	1.22			

Results

Comparison of the Development Trend of the Chinese and U.S. Construction Industries

Value added of the Chinese construction industry started from \$20,102 million, or only 5.3% of value added of the U.S. construction industry in 1979, and reached \$474,206 million, or more than 74% of value added of the U.S. construction industry in 2008. Value added of the Chinese construction industry grew at a 12.0% average growth rate, which was five times more than the average growth rate of value added of the U.S. construction industry. Likewise, Gross Output Value of the Chinese construction industry began at only 5.3% of Gross Output Value of the U.S. construction industry in 1980, or \$37,844 million, growing at a 15.3% average growth rate, and hit over \$1.7 trillion in 2008, overtaking Gross Output Value of the U.S. construction industry by 34.8%.

Figures 1 and 2 illustrate the comparison of the growth of value added and Gross Output Value of the Chinese and U.S. construction industries based on PPP from 1978 to 2008 (solid lines). The two economic indicators of the Chinese construction industry started at very low points compared with those of the U.S. construction industry. However, they grew much faster than the latter with no obvious decline. Before 1988, both indicators of the Chinese construction industry had relatively low values, because the base numbers of the two indicators in late 1970s were small. From 1988 to 1991, the average growth rates of the two indicators dropped appreciably to only 1.2% and 2.3%, respectively. During 1992 and 1993, however, both indicators climbed greatly at very high average growth rates of 35.3% and 36.9%, respectively. After this fluctuating period, the Chinese construction industry grew more stably and since 2002, the industry had entered another boom period, when both indicators rose dramatically at relatively high growth rates. On the other hand, the U.S. construction industry experienced four small recessions during the 30 year period, which were in 1980, 1990, 2002, and 2007. In these four years, both value added and Gross Output Value of the U.S. construction industry either remained stable or declined. Despite these minor setbacks, the two economic indicators of the U.S. construction industry grew steadily at the average growth rates of 2.0% and 1.8%, respectively, and reached a peak in 2006.

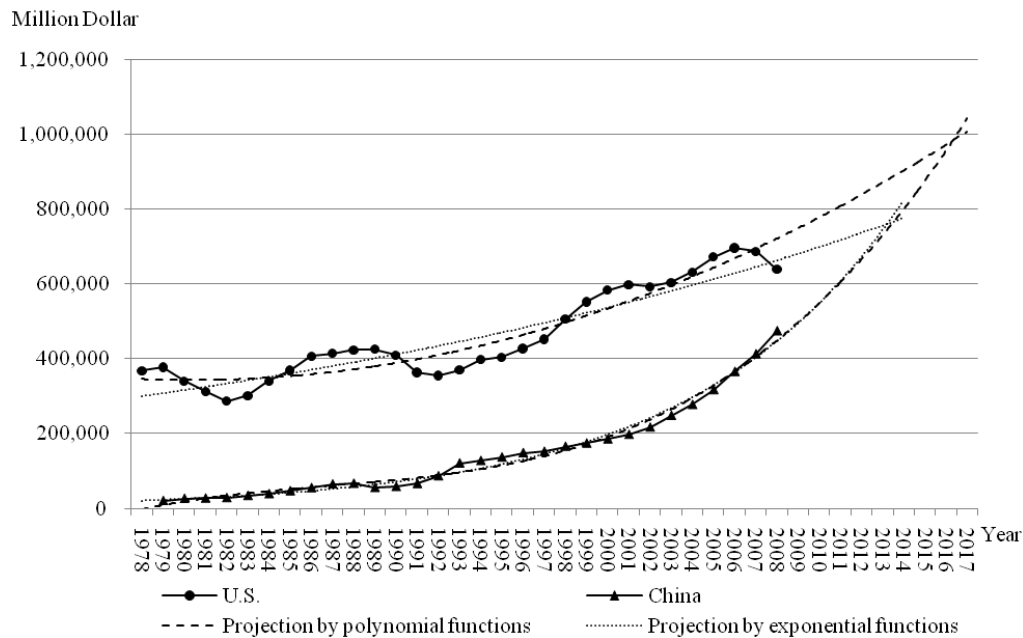


Figure 1: Comparison of Value Added of the Chinese and U.S. Construction Industries Based on PPP

Projection of Future Development of the Chinese and U.S. Construction Industries

Projections of the future development of Chinese and U.S. construction industries were based on the following assumptions: (1) the growth rates of economic indicators will keep similar to current values; (2) political policies will remain stable and no military conflicts will occur; (3) enough resources are available to support industry growth; and (4) exchange rates stay the same as those used in this research, which are the official exchange rate of one U.S. dollar equaling to 6.85 Chinese yuan, and the PPP conversion factor of one U.S. dollar equaling to 3.6 Chinese yuan. Projections of value added and Gross Output Value of the Chinese and U.S. construction industries were conducted using both polynomial functions and exponential functions, which can best fit existing data and largely match their growth trends.

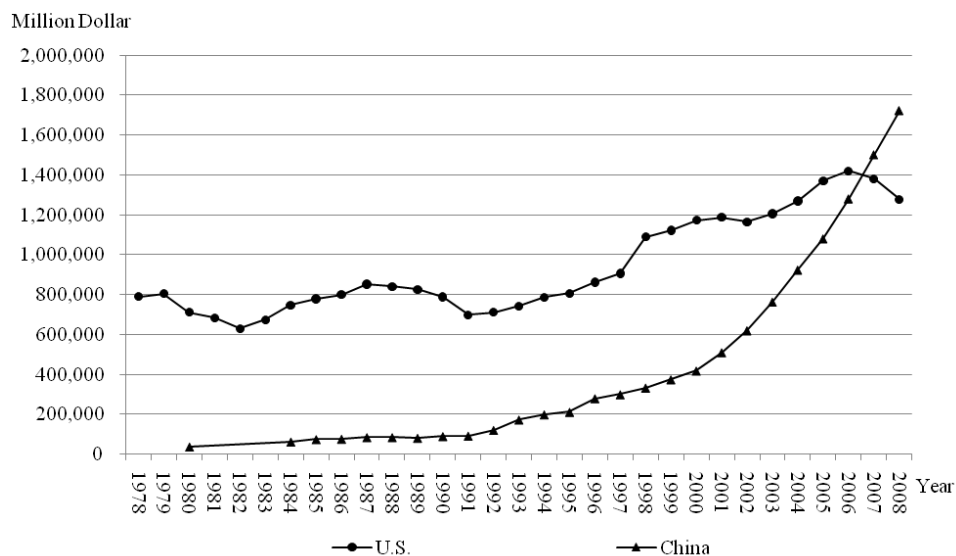


Figure 2: Comparison of Gross Output Value of the Chinese and U.S. Construction Industries Based on PPP

Projection Based on Official Exchange Rate

Figure 3 displays the projections of value added of the Chinese and U.S. construction industries based on the official exchange rate. The polynomial functions (dash lines) suggested that value added of the Chinese construction industry will overtake value added of the U.S. construction industry at about \$1.7 trillion in 2033, whereas exponential functions (dotted lines) showed this will happen 11 years earlier in 2022 at about \$1 trillion.

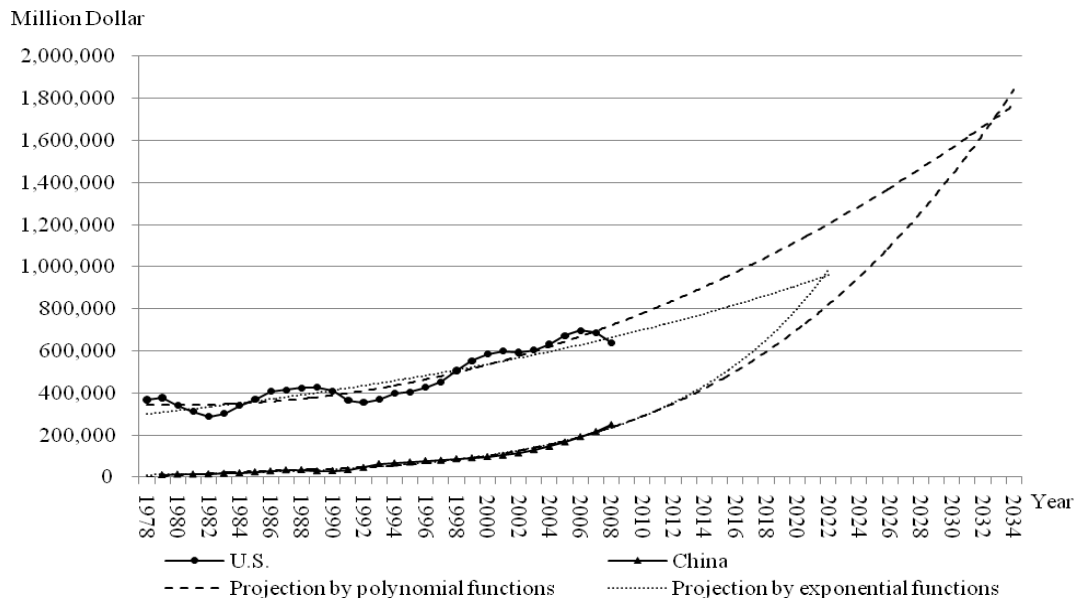


Figure 3: Projections of Value Added of the Chinese and U.S. Construction Industries Based on Official Exchange Rate

Figure 4 presents the projection of Gross Output Value of the Chinese and U.S. construction industries based on the official exchange rate. According to polynomial functions, Gross Output Value of the Chinese construction industry will surpass Gross Output Value of the U.S. construction industry at about \$1.8 trillion in 2014, while it will take place at the beginning of 2013 at about \$1.4 trillion, as exponential functions suggested.

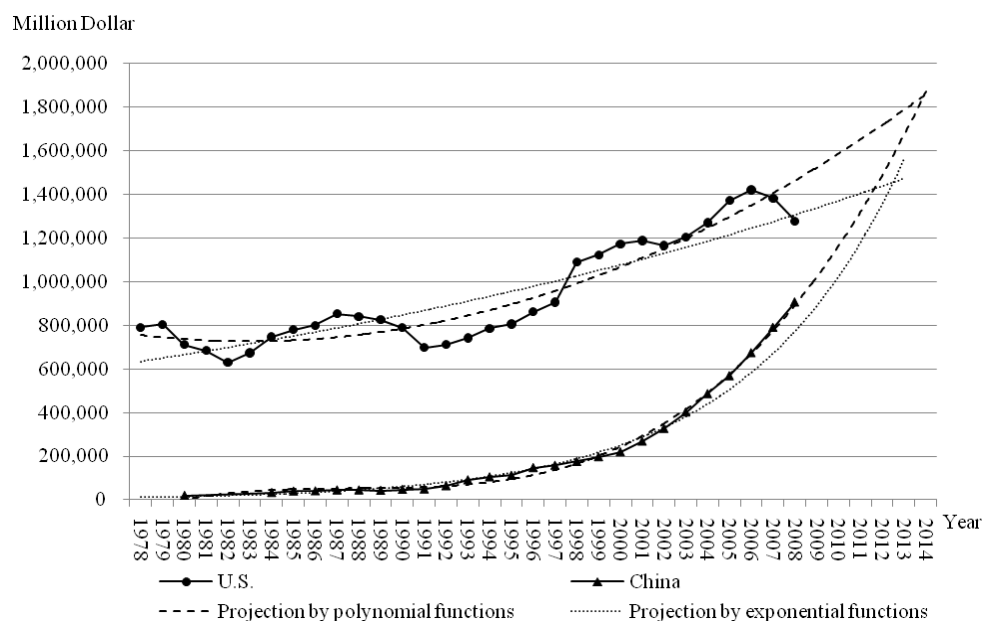


Figure 4: Projections of Gross Output Value of the Chinese and U.S. Construction Industries

Based on Official Exchange Rate

Projection Based on PPP Conversion Factor

The projection of value added of the Chinese and U.S. construction industries based on PPP is also illustrated in Figure 1 with dash lines and dotted lines. The polynomial functions showed that value added of the Chinese construction industry will be equal to value added of the U.S. construction industry at about \$1 trillion at the end of 2016, while the equalization will happen in 2013 at about \$800 billion, according to exponential functions.

Gross Output Value of the Chinese construction industry based on PPP has surpassed Gross Output Value of the U.S. construction industry since 2007, as displayed in Figure 2. Thus, no projections were made on Gross Output Value of the Chinese and U.S. construction industries based on PPP. Results of projections of when the Chinese construction industry will surpass the U.S. construction industry, and at what value amount, based on official exchange rate and PPP by polynomial and exponential functions are presented in Table 2.

Table 2

Projections of the Chinese Construction Industry Surpassing the U.S. Construction Industry

Method	Parameter	Polynomial Functions		Exponential Functions	
		Surpass Year	Value	Surpass Year	Value
Official	Value Added	2033	\$1.7 trillion	2022	\$1 trillion
Exchange Rate	Gross Output Value	2014	\$1.8 trillion	2013	\$1.4 trillion
Purchasing	Value Added	2016	\$1 trillion	2013	\$800 billion
Power Parity	Gross Output Value	2007	\$1.4 trillion	2007	\$1.4 trillion

Discussion and Conclusion

Value added and Gross Output Value of the Chinese construction industry started at very low points compared with those of the U.S. construction industry in the late 1970s, however, they grew at higher rates than the latter with no obvious decline. The U.S. construction industry, on the other hand, experienced four apparent setbacks in 1980, 1990, 2002, and 2007. By 2008, value added and Gross Output Value of the Chinese construction industry had reached 74.2% and 134.8% of those of the U.S. construction industry, respectively, based on PPP.

Value added of the Chinese construction industry is projected to surpass value added of the U.S. construction industry between 2013 and 2016 at the value between \$800 billion and \$1 trillion based on PPP. Gross Output Value of the Chinese construction industry is projected to overtake its U.S. counterpart between 2013 and 2014 at the value between \$1.4 trillion and \$1.8 trillion, and value added of the Chinese construction industry is projected to surpass its U.S. counterpart between 2022 and 2033 at the value between \$1 trillion and \$1.7 trillion based on the official exchange rate. Compared with the other two projections, the estimation of value added of construction based on the official exchange rate gives a larger range of both time and value (11 years and \$700 billion). Since value added of the Chinese construction industry based on PPP and Gross Output Value of the Chinese construction industry based on the official exchange rate reached 74.2% and 70.9%, respectively, of their U.S. counterparts in 2008 (see Figures 1 and 4), whereas value added of the Chinese construction industry based on the official exchange rate was only 39.0% of value added of the U.S. construction industry in 2008 (see Figure 3), thus, projections of value added of the Chinese and U.S. construction industries based on the official exchange rate are subject to greater variance.

After China's admission to the WTO and due to its continual modernization of its laws and regulations, foreign funded firms have broken the barriers into the Chinese market and have gained more market share. As the Chinese government encourages more construction projects to be built to international standards, U.S. AEC firms that are interested in conducting business in China have a good opportunity to enter this market, one with huge potential. At the same time, U.S. AEC firms will also need to consider their vulnerability compared with local firms, and have to become familiar with Chinese government policies, laws and regulations, and the local business environment.

References

- Allmon, E., Haas, C. T., Borcharding, J. D., & Goodrum, P. M. (2000). U.S.construction labor productivity trends, 1970-1998. *Journal of Construction Engineering and Management*, 126(2), 97-104.
- Chui, K. W. & Bai, Y. (2009). *Comparison of contract general conditions between the U.S. and China: Becoming more competitive in the Chinese construction market*. VDM Verlag, Saarbrücken, Germany.
- Eschenbach, T. G. (2003). *Engineering Economy*, 2nd Ed, Oxford University Press, New York, New York.
- Goodrum, P. M., & Gangwar, M. (2004). The relationship between changes in equipment technology and wages in the US construction industry. *Construction Management and Economics*, 22, 291-301.
- Huang, Y. & Bai, Y. (2010). *The growth trend of the Chinese construction industry: When it will surpass the U.S. construction industry*, VDM Verlag, Saarbrücken, Germany.
- Lam, Y. T., & Chen, Z. (2004). The development of the construction legal system in China. *Construction Management and Economics*, 22, 347-356.
- Mayo, R. E., & Liu, G. (1995). Reform agenda of Chinese construction industry. *Journal of Construction Engineering and Management*, 121(1), 80-85.
- Shen, L. Y., Li, Q. M., Drew, D., & Shen, Q. P. (2004). Awarding construction contracts on multicriteriabasis in China. *Journal of Construction Engineering and Management*, 130(3), 385-393.
- The World Bank. (2009). *World Development Indicators 2009*. Washington, D.C.
- U.S. Department of Labor. (2004). America's construction industry: Identifying and addressing workforce challenges. Report of findings and recommendations for the high growth job training initiative in the construction industry. URL http://www.doleta.gov/brg/pdf/High_Growth_Construction_Report_Final.pdf.
- Xu, T., Tiong, R. L. K., Chew, D. A. S., & Smith, N. J. (2005). Development model for competitive construction industry in the People's Republic of China. *Journal of Construction Engineering and Management*, 131(7), 844-853.