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# Data-driven Assessment of Market Share Growth Factors of Union Electrical Contractors in the U.S.

**Hisham Said<sup>1</sup> and Ajay Deshmukh<sup>1</sup>**

<sup>1</sup>Santa Clara University, Santa Clara, California

Building trade unions have had an instrumental role in advocating for worker welfare, training, health and safety in the U.S. construction industry. Since 1970s, the membership and market share of trade unions have dramatically declined, and there is no clear understanding and previous scholarly assessment of the drivers of such decline. This study provides a data-driven assessment of the market share controlling factors of the U.S. electrical trade unions and their signatory contractors. The study depended on collecting a large amount of data from the union electrical contractor organization, government census agencies, surveys, and interviews of electrical contractors. Union market share trends were found to be correlated to the use of higher crew ratios and the adoption of non-apprenticeship worker classifications.

**Key Words:** union, electrical construction, labor relations, market strategies, data analytics

## Introduction

The construction trade unions in the United States have had a central role in the worker rights and social justice movements. The United Brotherhood of Carpenters was the first trade union to be established in 1881, followed by other trades like bricklayers, iron workers, operating engineers, painters, plasterers, plumbers, sheet metal workers, and electricians. The trade union coverage of the workforce (also called union market share) reached its peak in 1970s to be around 35%, but has declined since then to be 13.8% in 2018 (Hirsch and Macpherson 2019). Extensive research have been done to study the general area or worker rights and unionization, but few studies have focused on the building trade unions and the factors that contributed to their market share decline (Maloney and McFillen 1994; Erlich and Grabelsky 2005; Belman and Smith 2008; Kosla 2015).

This pilot study aims to provide initial assessments of the factors that contribute to the market share decline or growth of the U.S. electrical trade union. The study focused on the electrician construction union, represented by the International Brotherhood of Electrical Workers (IBEW), which bargains

national and local agreements with the National Electrical Contractors Association (NECA). Although the trade unions share common commitment to worker welfare and training, each trade is expected to have a different set of market share determinants due to their differences in industry priorities, construction practices, and sizes. The paper is organized in 3 main segments. First, a set of possible market share factors are proposed and explained. Second, the data collection methodology is elaborated. Third, the major study findings are presented.

### Union Market Share Hypothesized Factors

Literature review, interviews and town hall meetings were utilized to identify potential factors that can impact the market share of the electrical construction trade union. Available online newsletters and publications of NECA and IBEW were reviewed to identify the main factors impacting trade union market share. These factors were validated through interviews with 3 NECA chapter managers and organizing town hall meetings with their members and counter labor organizers from their IBEW local unions. The following is not an exhaustive list of all market share determinants, but it includes 8 factors that are mainly within the control of IBEW and NECA:

- 1) Low-voltage (LV) work: LV work includes the engineering and constructing of data, communication, building automation, and fire safety systems. LV worker goes through a dedicated apprenticeship program and classification, called Installer-Technician. It is hypothesized that higher LV work volumes can improve union market share levels. LV work is seen by some ECs as the gateway to expand into the growing smart building market.
- 2) Project Labor Agreements (PLAs): Owners of public and private projects get into PLAs with trade unions to guarantee a stable supply of local quality construction workers and minimize the disruptions from labor-management conflicts. It is hypothesized that the IBEW local unions with more PLA involvement will support positive market share trends.
- 3) Mega projects: Both positive and negative impacts can be realized when a local union is involved in a mega project, like data centers and power plants. These projects can result in positive market share trends, but they also disrupt the local union operations and training due to the short-term nature of these projects.
- 4) National maintenance agreements (NMA): The IBEW national office can sign NMA with large enterprises (like manufacturing and power companies) to secure maintenance employees from the union members in any local jurisdiction in the country. There is a conjecture that these NMA provide secured long-term employment of the union members, which support positive market share trends.
- 5) Portability agreements: IBEW has a limited national portability agreement where an EC can bring only 4 electricians from the ECs' home local union to another local union. Some local unions get into regional portability agreement to allow ECs to move more of their key workers and supervisors across the jurisdiction lines of the local unions. It is hypothesized that the existence of these expanded portability agreements can support the market share growth of the local unions.
- 6) Market recovery agreements (MRA): In areas of tough competition with open-shop contractors, the local union and their signatory contractors negotiate short-term amendments to their collective bargaining agreements (CBA) to waive some of the labor agreement typical requirements to make the union contractors more competitive. It is hypothesized that these market recovery agreements are effective in growing the market share of the IBEW local unions.
- 7) Relaxed crew ratios: A central issue in a trade CBA is the ratio journeymen to each apprentice to provide enough supervision and training for the apprentice. Higher crew ratio results in stronger apprenticeship programs and supervision, but it increases the crew composite rate and degrades

the competitiveness of union contractors. It is hypothesized that lower crew ratios support the market share growth of a local union.

- 8) **Non-apprenticeship classification:** The IBEW has different trade classifications that are built upon strong apprenticeship training programs, like inside wiremen, residential, low-voltage technicians. In early 2000s, IBEW and NECA introduced a non-apprenticeship classification that involved 2 advancements ranks: construction wiremen (CW) and construction electrician (CE). The CW/CE classification system allows non-union electricians to join IBEW workforce, but without the requirement of enrolling in its 4-year or 5-year apprenticeship programs. Workers under the CW/CE classification get less hourly pay rates and benefits compared to the regular apprenticeship-based classification, but they are expected to work on construction tasks with less lower trade skill expectations. The CE/CW classification system is generally supported by NECA and its member contractors, because it helps to lower the crew composite cost rate.

## Data Collection

The study involved a data collection methodology that balanced between the detailed understanding of market share determinants and the representation of the collection data. The study data was collected from 3 main sources: union market share reports, an online survey, and interviews.

### *Market Share Data*

The market share data of union electrical contractors was obtained from the National Labor-Management Cooperation Committee (NLMCC) annual market report. NLMCC is a national organization and trust fund that was co-established by the management (i.e. NECA) and the labor (i.e. IBEW) sides of the union electrical construction industry. NLMCC publishes an annual report that provides estimates of the employment (work hours) of both union and open-shop electricians, which is used to calculate an employment-based market share metric. The employment estimates are calculated based on available data from the government (Bureau of Census and Bureau of Labor Statistics) and the national pension fund of union electricians. Despite the accuracy issues with NLMCC market share data, it is considered the main market metric that is mutually accepted by both contractors and the union in bargaining and dispute resolution. The NLMCC data was obtained for the period 2004 – 2017, and it includes the employment-based market share levels of 255 IBEW local unions and their corresponding NECA chapters.

The NLMCC data was parsed, processed and analyzed to generate a new market share trend metric to classify the IBEW local unions based on their market share performance rather than their absolute levels. First, the data was parsed and reorganized to allow a data-series trend analysis. Second, a simple trend analysis algorithm was developed and applied to the data to classify each local union to have either a positive or negative market share trend. A positive trend includes a market share growth trend or a rebound trend, while the negative trend is used to represent shrinking local unions or those that experienced shrinking after a period of growth (up-down). The trend classification analysis revealed that: 18% of the local unions showed consistent growth trend, 29% of them experienced a rebound trend, 45% of the unions contracted after a growth period due to the 2008 economic recession (up-down trend), and 8% of the locals exhibited consistent shrinking market share trend.

### *Online Survey of Union Market Share Factors*

The second data source involved surveying the unionized electrical construction stakeholders on the factors that affect their market share performance. The survey used Qualtrics, an online platform that

facilitated the design of a dynamic survey able to accept responses from three possible participants: NECA chapter staff, IBEW local staff, and electrical contractors (ECs). The survey was structured to ask each participant to assess the impact of each of the hypothesized factors on the market share growth in their IBEW local unions. The survey link was shared with NECA's email list and was published online for two months. A total of 66 participants completed the survey: 38 NECA executives, 24 electrical contractors, and 4 IBEW and JATC staff members. These participants provided data coverage for 53 IBEW local unions since some participants came from the same local.

### *Interviews of Union Contractor Association Chapters*

The purpose of the interviews was to validate and complement the survey findings by collecting the same data in a detailed interactive approach. Conducting the interviews required clustering the IBEW local unions, and designing a unified interviewing protocol.

To select a sample of local unions for the interviews, the researchers clustered IBEW local unions into groups of similar economic, social, and workforce conditions. Figure 1 shows the process used in clustering the local unions based on the selected attributes. First, the census data of 20 local attributes were collected and aggregated for the IBEW local unions. Table 1 summarizes the collected data and their sources. Most of these data are provided per county, so the data had to be aggregated to the IBEW local unions by relating the locals to their jurisdiction counties.

Table 1

*The collected census data of the social, economic, and workforce conditions of the local unions*

Local Attribute	Collected Data
Gross domestic product	Maximum recorded Gross Domestic Product value (USBEA 2015)
Building permit	2017 residential building permits by county (USCB 2017-a)
ECs and their employment	Number of ECs and employees in residential, commercial, and industrial construction industries (USCB 2017-b)
Unemployment	Unemployment percentage (USCB 2019)
Political balance	State Legislative Election data (1967-2016) (Klarner 2018)
Population	Total population and composition (USCB 2017-b)
High school holders	Percent of adults with a high school diploma only (USDA 2017)
Associate degrees	Percent of adults with associate's degree, (USDA 2017-a)
Bachelor's degrees	Percent of adults with a bachelor's degree, (USDA 2017-a)
Poverty level	Poverty %, (USDA 2017-b)
Union market share	Average employment market share in 2004 – 2017 NLMCC data
Prevailing wage	The existence of prevailing wage law in the state
Minimum wage	The value of the minimum wage (if any) in the state
Right-to-work laws	The existence of state Right-to-Work (RTW) laws (NRTWC 2016)

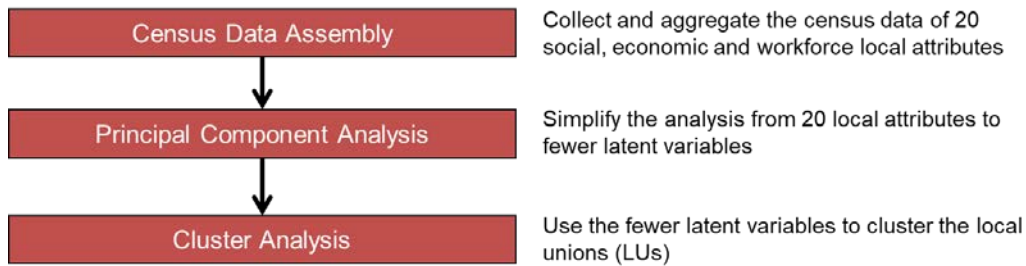


Figure 1. Sampling procedure for clustering the IBEW local unions (LUs) for interviews

The collected local census data were reduced to a handful of implicit factors that assess the economic, social, and workforce conditions of every local union. Principal Component Analysis (PCA) was applied as a data reduction technique (Jolliffe 2002) to reduce the dimensionality of the problem and allow a reliable clustering of the local unions. PCA allows capturing the variances in the large number of considered attributes into a smaller set of attributes, by using a linear weighted average of the related original attributes. The PCA application was statically acceptable (Marija 2009) as shown by the high Kaiser-Meyer-Olkin (KMO) test value (0.875, very close to optimal value of 1.0) and the null hypothesis rejection of the Bartlett’s Test of Sphericity (close to zero value of significance). Figure 2 shows the five discovered latent factors that can be implied by the original 20 attributes of the local unions. For example, the first latent factor (market size) is positively implied by the size of the local population, number of local residential building permits, construction employment size, and number of construction firms. On the other hand, the third latent factor (pro-union environment) is implied positively by the union market share, prevailing wage, and minimum wage. However, the pro-union environment is also negatively implied by the existence of RTW laws. Reducing the considered local attributes to only five will allow clustering the local unions in a statically reliable way.

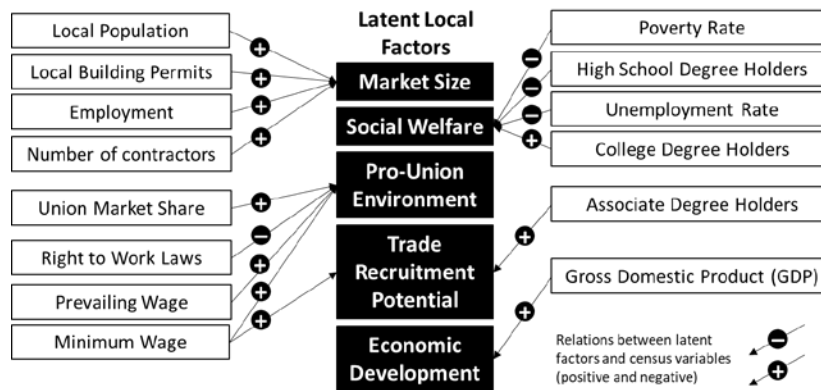


Figure 2. The identified latent local social, economic, and workforce local union market factors

Finally, the local unions were clustered using the identified five latent variables. Using a statistical clustering method (K-Means clustering, Aggarwal and Reddy 2014), the IBEW local unions were organized into groups of relatively similar values of the five latent factors. After trying different cluster numbers, clustering the local unions into seven clusters provided reasonably homogenous groups of similar locals. Figure 3 shows the clustered IBEW local unions geographically.

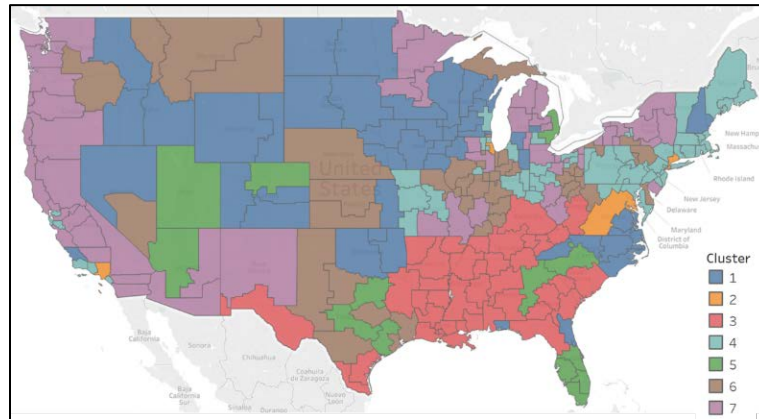


Figure 3. The IBEW local unions grouped into 7 clusters with similar market conditions

The clustered local unions provided a guideline on which chapters to approach for an interview in order to achieve a representative sample of the union electrical construction nationwide. From each cluster, the local unions with either growing or shrinking market share trends were approached for the interviews. The purpose is to learn the practices or factors that contributed to both growing and shrinking the market share in different local unions. For each selected local union, the executive director of the corresponding NECA chapter was invited for a 1-hour interview to collect the data of the studied local union and discuss the factors leading to the observed market share trend. A template of questions was designed and used in each interview to maintain data collection consistency.

### Study Findings

The following are the main findings based on the inspected correlation between the market share trend (from NLMCC) and the eight market share determinants (their data from the surveys and interviews):

- 1) Growing local unions showed slightly larger Tech Installer programs, if the low-voltage work can be sustained in local market. 50 – 60% of the surveyed local unions reported no impact from low-voltage work on their market share. This observation is clarified during the interviews, when the NECA chapter managers confirmed that low-voltage apprenticeship programs could not be sustained due to the lack of low-voltage work and specialized contractors. Even if the low voltage work exists on an occasional basis, regular inside wiremen are used for installing such systems. However, local unions that managed to sustain a low-voltage program showed slightly more market share growth signs. Growing local unions had around 10% of their working members in the Tech Installer program, compared to 7% for the shrinking local unions.
- 2) Unexpectedly, PLAs were found not to apply to half of the studied local unions. Heavily depending on PLAs was found to be correlated with shrinking market share trends. More than half of surveyed local unions reported no PLAs or no impact from PLAs on their market share. PLAs were not applicable for around 60% of the surveyed local unions, for both publicly-funded and privately-funded projects. Shrinking local unions showed a high dependency on PLAs. The shrinking local unions are three times more dependent on PLAs, compared to the growing local unions during the same time period of 2004 – 2017. Despite the benefits of PLAs to increase the employment of union contractors, their existence is a sign of shrinking or small local unions.
- 3) 40 – 50 % of the survey respondents reported that mega projects had no impact on their market share, probably due to the non-existence of such projects in the respondents' local unions.

However, interview data revealed that these mega projects result in an “artificial” market share growth that was solely caused by the many labor-hours of these projects and was not generated by any growth strategies or unique initiatives. Growing local unions had, on average, double the number of mega projects between 2004 – 2017 (0.9 project per local), compared to shrinking local unions (0.43 project per local).

- 4) NMAs had no impact on growing or shrinking local unions. 60% of the survey’s local unions had no involvement in national maintenance agreements. Even if they exist, these agreements do not result in significant union labor-hours.
- 5) Portability was perceived to have a positive impact on market share. About 65% of the survey respondents reported that open portability contributed positively to their market share. For around 25% of them, portability was not a notable market share determinant. However, 18% of the surveyed shrinking local unions report that open portability negatively affected their market share. This has been the case for the local unions in the suburb of large construction-active cities like San Francisco and Seattle where much higher wages and portability drain portability-out locals from their own electricians.
- 6) MRAs are more common in shrinking local unions, but their limited scopes do not help in recovering the market. Only 35% of the shrinking locals and 42% of the growing locals reported positive impacts of MRAs on the union market share. In most survey responses, MRAs had no impact or were not applicable. As shown by the interview data, 80% of the interviewed shrinking local unions had either local or regional MRAs, compared to 45% of growing locals. Most MRAs cover only small, non-industrial projects like gas stations, strip malls, retail, and residential.
- 7) It was evident that the growing local unions benefited from relaxed crew ratios. 85% of the survey’s growing local unions said relaxed crew ratios supported their market shares, compared to 59% of shrinking local unions. As supported by the interview data, the collective bargaining agreements in the growing local unions allow for around 2 journeymen to every 3 apprentices (0.67 ratio). This ratio increases to around 1.25 Journeymen-to-apprentice in the shrinking local unions. Relaxed crew ratios are not applicable in states with favorable union laws that support strong apprenticeship programs by requiring higher crew ratios.
- 8) As another evident observation, the CE/CW worker classification was instrumental for local unions to grow their market share. Most respondents from both the growing and shrinking local unions acknowledged the positive impact of the CE/CW classification on the union market share and improved competitiveness of the union electrical contractors. The interviewees further confirmed this observation. The CE/CWs represented 25% of working IBEW members in growing local unions, compared to 3% in shrinking locals.

## Summary

This paper provides the results of a pilot study of the impact of some hypothesized trade union attributes on the market share of the union signatory electrical contractors. The study depended on collect large amount of data from the union and government census agencies. Additional data was obtained through surveying and interviewing a sample of electrical contractors, NECA executives, and IBEW business managers. The interview effort and survey resulted in relatively small samples of data, but they were provided opportunity for cross-validation of the study findings.

Qualitative assessment of the collected data revealed evident correlation between the union market share trend (i.e. growth or shrinkage) and 2 factors that can directly improve the union signatory contractor competitiveness: relaxed crew ratios and the use of non-apprenticeship worker classification (i.e. CE/CW). Reducing the journey-apprentice ratio and allowing the use of more

CE/CWs will directly result in decreasing the crew composite cost rate of the union contractors, and make them more competitive against open-shop contractors who have steadily improved the efficiency of their operations and the quality of their workers. The market of low-voltage systems can support the growth of the IBEW union in the future when the market grows to a degree to sustain the business of specialized LV contractors and dedicated union apprenticeship programs.

The study findings and data can propel further research in the areas of quantitative assessment and modeling of construction union market dynamics. With the collection of more data, advanced statistical analysis can be performed to validate the above findings and develop more in-depth understanding of the union market share drivers. Also, agent-based and simulation modeling can be used to assess the effectiveness of technological and workforce strategies in supporting the growth of construction trade unions.

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