

# Jobsite Behaviors of Unionized Mechanical Foremen Relative to Knowledge of the Project Budget

Zach Seibert, MS and Mark Shaurette, PhD and Bryan Hubbard, Associate Professor and Brad Benhart, Associate Professor of Practice  
Purdue University  
West Lafayette, IN

This is an exploratory study which attempts to find a relationship between knowledge of the project budget and the jobsite behaviors of unionized mechanical foremen. Literature on the topics of budget participation and participative management led the authors to believe that a relationship would exist between these variables. Previously validated scales were used to measure jobsite behaviors, occupational commitment and knowledge of the project budget. Multilinear regression analysis showed no relationship between knowledge of project budget and jobsite behaviors. Minor support was revealed for the positive relationship between a foreman's career commitment and their pace of work. Significant correlations between independent variables also revealed relationships between employee commitment to their job and employee commitment to their career as well as employee commitment to their employer and lunches with the boss.

**Key Words:** Foreman; behaviors; budget; budget knowledge; budget participation

## Introduction

In the construction industry, project profitability is consistently among one of the key indicators of project success (Hughes, Tippet, & Thomas, 2004). Having a profitable project is a goal first established by the rigid confines of the project budget. Cherrington & Cherrinton (1973) described the budget as "A major tool used in business to express quantitatively a plan of action to coordinate and implement the plan, to evaluate efforts to achieve it, and to control activities in the organization" (p. 226). The budget for a construction project is created by itemizing and defining the different work categories required to complete a project and allocating an appropriate amount of labor hours, material and equipment to complete each category. Project managers are tasked with finding ways of making costs come in within this framework regardless of how well the project is bid and subsequently budgeted. Wen & Chan (2014) revealed that from a project management perspective, management's greatest influence is over project labor.

The goal of this study was to determine whether or not a positive relationship existed between a foreman's knowledge of the project budget and their jobsite behaviors. It is the authors' experience that greater budget knowledge can lead to improved behaviors as long as a healthy relationship exists between management and labor. For example, while monitoring job costs for the self-perform aspect of one project, an author discovered that 80% of the money allotted for labor had been spent while less than 50% of the work was actually complete. The author then shared this information with the foreman and conceded that he was okay with losing money, but would like to minimize the loss as much as possible. Two weeks later the job was complete and job costs came in under budget.

This example could be a unique circumstance, but nonetheless shows the effects budget knowledge can have on project performance. This example also makes one question whether or not this form of engagement would work in all circumstances. The authors believe that it would not. Labor productivity is influenced by hundreds of different management factors and project parameters and there is no industry wide agreement on which are the most influential (Tsheyayae & Fayek, 2014). Thus, the author's relationship with the workers, the way he presented the information, the tenure of the employees at the company and whether or not the budget created realistic goals and set a realistic pace of work, all affect whether or not the project would have been profitable following the presentation of the budget goals. The literature on this topic also indicates the wide range of factors which influence worker attitudes, behaviors and performance.

Maslow's (1943) hierarchy of needs, McGregor's (1957) Theory Y, Ouchi and Jaeger's (1978) Theory Z and Pink (2009) all point to the importance of treating labor as more than a necessary tool in accomplishing a task. Workers are motivated by more than just a paycheck. Workers are human beings with complex needs. They wish to be given responsibility, be engaged on a personal level and they desire long term employment. Workers don't merely wish to be workers, they seek meaning and have complex needs. However, there is also evidence for the effects of the extrinsic motivation of money.

House (1971) mentions that workers with greater freedom and control over setting and accomplishing their goals are more intrinsically motivated as the reward for accomplishing their goals is self-fulfilling. While the complex tasks in construction generally support the opportunity for autonomy (Coffey & Langford, 1998), Pink (2009) goes on to explain that the greater the mechanical skills required for a task versus complex cognitive skills, the greater impact monetary incentives will have. Construction tasks are arguably some of the most mechanically inclined. Thus, evidence should exist to support some association between construction worker motivation and monetary incentives.

Research by Cox, Raja, and Frey (2006) in the field of construction sought to determine the factors that contribute to subcontractor employee motivation. When investigating the preferred method of incentive, "money was suggested to be the incentive of choice" (Cox et al., 2006, p. 158). These findings are further reinforced through work by Patchen (1987) and Tippet and Kluvers (2009). Patchen (1987) insists that in order for employees to continue to produce at a higher level of output, they must be able to see, "What's in it for me?" (Patchen, 1987, p. 41).

Rewarding employees through recognition and monetary incentives are examples of how to reinforce positive work behaviors. Yet, rewards can only go so far. The literature also speaks to the importance of getting employees to buy into the goals set by management. This is accomplished through participative management and, even more relevant to this study, budget participation. Participative management embodies the aspects revealed in the literature to contribute to intrinsically motivating employees, (i.e. autonomy, two-way dialog, respecting workers, defining goals and providing feedback). In participative management, management still sets the objectives for production and quality, but workers are given greater control over how the goals are achieved (Hodson, 2002).

Budget participation takes the aspects of participative management one step further by getting the worker involved in the budget setting process. Participating in the budget process creates buy-in as employees operating within the budget limits are more willing to accept the budget goals if they are involved in setting those goals (Cherrington et al., 1973; Lafferty, 2007). A more effective means of getting workers to buy into company goals is through participation. Budget participation in construction is limited, however, as the competitive bidding process places a cap on the budget and the amount of influence foremen can have over the budget goals. For this reason, participation in this study was measured as the foreman's knowledge of the budget and not necessarily their participation.

Based on the literature reviewed for this topic, the following alternative hypotheses were evaluated:

- (1)  $H_A^1$ : Increased occupational commitment is associated with improved jobsite behaviors.
- (2)  $H_A^2$ : The greater the employee tenure with the company, the worse their jobsite behaviors.
- (3)  $H_A^3$ : Increased knowledge of project budget is associated with improved jobsite behaviors.

## Method

To investigate the effects of budget knowledge on foremen behavior, the authors chose to delimit the study to unionized mechanical foremen in central Indiana. The study was delimited to a single trade to avoid potentially confounding variables that may have arisen from surveying foremen from multiple trades. Variations in income, job duties, pride and exclusiveness among the different trades results in the tradesmen of each field possessing characteristics unique to their specific trade. The region of the study was selected based on the authors' place of residence.

Both qualitative and quantitative data were collected. Qualitative data was collected through semi-structured interviews with project management which provided insight into the management style of each participating organization. Specifically, interviews helped determine the extent to which management shares budget information with foremen and the type of information they share. The interviews also helped develop survey questions specific to the mechanical trade to be used in an emailed survey to mechanical foremen.

The completed survey was distributed via email to the foremen of the companies which participated in the interview process. Additionally, the researchers solicited a wider survey population by calling and emailing other companies omitted from the interview process and requesting the use of the email addresses of their foremen. Finally, a broader population was reached through the distribution of an anonymous survey link by the Mechanical Contractors Association of Indiana. The contact at the MCAI distributed the anonymous survey link to all union mechanical contractors in the state of Indiana.

The completed survey included one dependent variable, four independent variables and five separate descriptive, questions to control for age, ethnicity, gender, tenure with trade and job title. Table 1 lists all variables used.

**Table 1**  
*List of Variables*

Dependent	Independent	Control
Jobsite behaviors	Knowledge of project budget	Age
	Occupational commitment	Ethnicity
	Tenure with company	Gender
	Incentive use	Tenure with trade
		Job title

Previously validated scales by Balsler and Winkler (2012), Milani (1975) and Meyer, Allen and Smith (1993) were used to measure jobsite behaviors, budget knowledge and occupational commitment, respectively. Occupational commitment was broken down into two separate measures for commitment to career and commitment to employer as outlined by Meyer et al. (1993). Incentive use was measured by asking participants to indicate the extent to which they received seven unique rewards which were evident from interviews to be common in construction. Tenure with company, tenure with trade and age were measured with open ended questions. All remaining control variables were measured with multiple choice questions for ethnicity, gender and job title.

Due to the need to compare multiple independent variables to the dependent, the data was analyzed using multilinear regression analysis. Mean scores were used in evaluating Likert scales for behaviors, knowledge, occupational commitment and incentive use. Multilinear regression analysis allowed for the evaluation of three overall models for predicting behaviors and the impact of each variable within the models. Separate models were used in evaluating the impact of the independent variables on the three separate measures for behaviors as was outlined by Balsler et al. (2012). These models are displayed in a literary fashion by Figure 1.

$$\begin{aligned}
 \text{Pace of Work} &= \beta_0 + \beta_1 \text{Knowledge} + \beta_2 \text{Incentive} + \beta_3 \text{Tenure} + \beta_4 \text{Car. Com.} + \beta_5 \text{Emp. Com.} + \varepsilon \\
 \text{Prescribed Times} &= \beta_0 + \beta_1 \text{Knowledge} + \beta_2 \text{Incentive} + \beta_3 \text{Tenure} + \beta_4 \text{Car. Com.} + \beta_5 \text{Emp. Com.} + \varepsilon \\
 \text{Focus on Task} &= \beta_0 + \beta_1 \text{Knowledge} + \beta_2 \text{Incentive} + \beta_3 \text{Tenure} + \beta_4 \text{Car. Com.} + \beta_5 \text{Emp. Com.} + \varepsilon
 \end{aligned}$$

*Figure 1: Literary Display of Models*

## Qualitative Results

The authors conducted seven interviews with managers from six separate companies between April 28, 2017 and May 12, 2017. Each interview lasted for approximately one hour and all conversations were recorded for audio only. Interviews were semi-structured and a list of 22 questions was followed. Audio recordings were analyzed by the authors for emerging themes by listening to each audio file and recording responses to each question. Interviews were purposed not only in developing survey questions, but in understanding (1) the extent and form of budget information shared with foremen, (2) the extent that foremen are able to contribute to the budget, (3) the effects of tenure on performance and (4) the overall sentiments of foremen towards budgets.

Every interviewee stated that they perform a turnover meeting with their foreman before starting each project. The length and thoroughness of the meetings varied based on the size and complexity of each job, but all companies had a method for the transfer of knowledge to the foreman. The amount of information provided to the foremen was summed up simply by one of the project managers as, "Anything they want." Out of the six companies interviewed, three said they provide project and budget information in a three-ring binder, one said they provide a file folder box, one provides their information electronically and one was less specific saying that they like to present the budget to the foreman using a schedule with man days allotted for each piping system.

Overall, interviews showed that goals for projects were laid out by the project budget and that information was then transferred to the foremen during turnover meetings. Therefore, a process for setting goals for the foremen was well defined and performed by all companies. This aligns with Patchen's (1987) assertion that management must set goals for workers. While this shows a clear conveyance of information, further questioning was necessary to understand whether or not foremen have the ability to contribute to the budget. This would allow for true budget participation.

The literature speaks to the importance of a foreman's ability to contribute to the budget and thereby buy-in to the joint goals established by the project manager and the foreman in the process (Cherrington et al., 1973; Milani, 1975; Walker et al., 1999; Lafferty, 2007). In the interviews conducted by the researcher, three of the seven interviewees acknowledged consulting foremen in estimating projects, one in analyzing or revising the budget and five in pricing change orders. Only one contractor indicated that he did not reach out to foremen when estimating, budgeting or pricing project change orders. However, the contractor in question would reach out to peers within the office that had come up through the trades and were now project managers. Thus, consulting to some extent still occurred.

The one contractor that practiced budget review and revision during turnover meetings with his foremen stated that, "In the beginning I will break down the estimate and have the report and we'll go through it. In that way we know if the estimate and what we have there are realistic and if not we can adjust it and look at it that way... We try to look at it upfront so we can fix it." The advantage he said he gains in this process is that it starts the preconstruction process early by getting foremen to the table as early as possible. In this way they are able to provide their insight and a new perspective on how to reduce costs.

Project managers indicated that the disadvantage in gaining foremen input in estimating or establishing budgets was that they normally underestimate because they do not think of the little things. For this reason, project managers viewed input from foremen to be more so consultation, and would generally not hold foremen accountable for their input. Thus, project management will then have to adjust the estimate to accommodate for the foreman's oversites. However, in discussing foremen input on estimating project change orders, the advantage in consulting foremen was indicated to be their first-hand knowledge of the work. As stated by one Project Manager, "They are there and they understand what it takes to get something done."

The authors had initially suspected that foremen involvement in contributing to the project budget would be limited due to the constraints of the competitive bidding process. This suspicion was confirmed as only one of the seven interviewees acknowledged involving the foremen in adjusting the budget goals. Additionally, foremen do not seem to be held accountable by project managers as they ultimately view the estimating and budgeting process to be their responsibility and any input from foremen to be consultation.

The effects of tenure were also investigated in interviews due to the effects the literature indicated it might have. Balsler et al. (2012), Chong et al. (2002) and Ouchi et al. (1978) all spoke to the impact tenure can have. Ouchi et al. (1978) indicated that longer tenured employees would be willing to incur greater personal cost for the good of the company while Balsler et al. (2012) and Chong et al. (2002) both found that longer tenured employees show decreased performance. Tenure was discussed with each interview candidate to better understand how they view its impact.

Reviews seemed mixed on the effects of tenure among union mechanical tradesmen. On the whole, interviewees believed they had a good group of men that they trusted, and trust was consistently mentioned as a primary reason for foremen holding their positions. One interviewee stated that, "Trust is super important with my guys and I trust them with everything. If I didn't [trust them] they wouldn't be there." Another interviewee indicated that, "...I don't spend more than two hours a week on a jobsite. If I need to be there more...I need to find a new foreman, it is that simple." Given the lack of consensus by interviewees on the impacts of tenure and the mandate for a trusting relationship with foremen, the qualitative evidence does not seem to support one effect over the other.

Finally, in evaluating the overall sentiments of foremen towards project budgets, interviews gave mixed reviews. One interviewee regarded it as a "bad word" among foremen and one said that his foremen don't like to look at it because it includes "too many numbers." Another said his foremen consider the budget the "perfect world" scenario. Still another said that, "guys a lot of times just want to go and you have to pull them back and make them look." This commentary sounded much like what Argyris (1952) uncovered in his seminal work on the effects budgets had on factory workers over 60 years ago.

While there may be some misgivings concerning the goals set by budgets, foremen generally still like to know how they are performing on projects. Every interviewee stated that their men will ask at some point during the job how they are doing if they have not already been informed. It was also clear from interviews that management believed foremen cared whether or not jobs made money. One interviewee stated that, "most know in the long run [a company] can't continue to [lose money] if the company is going to continue to be around."

## Quantitative Results

The emailed survey was distributed on June 15, 2017 via the use of Qualtrics' web-based survey administration system. Recipients of the emailed survey included 112 known email addresses from 9 contractors who agreed to provide the email addresses of their foremen for the study. The anonymous email link was also distributed by the Mechanical Contractors Association of Indiana, MCAI, at this same time. After two weeks of data collection, a total of 30 responses was collected from the known email addresses and 8 responses from the anonymous link. Thus, the response rate for the known distribution to email addresses was roughly 27 percent. A response rate cannot be calculated for the anonymous link as the total distribution is not known. Of the 38 responses collected, 4 had to be eliminated for not completing the survey and 2 for identifying as 'other' for position in the descriptive question section. Therefore,  $n = 32$ .

Multiple linear regression analysis was conducted using Statistical Analysis Software (SAS). By breaking down the dependent variables into the three parameters of behavior as outlined by Balser et al. (2012), the authors were able to compare each independent variable and their combined effects with the separate measures for behavior. The analysis of each model began with all variables included and then proceeded by backwards selection to remove the least significant variables from the model until the most significant variables remained. Following analysis of all models, only the first model for Pace of Work showed any significance.

Backwards selection in the first model progressed by eliminating the independent variables in the following order due to their high p-values: (1) tenure,  $p\text{-value} = 0.9829$ , (2) incentive,  $p\text{-value} = 0.6047$ , (3) commitment to employer,  $p\text{-value} = 0.4360$  and (4) Knowledge,  $p\text{-value} = 0.4217$ . The remaining variable with any significance in the first predictive model for pace-of-work was career commitment, which had a p-value of 0.0255. The ANOVA table and regression coefficients are shown below.

Table 2  
*ANOVA Output for Pace of Work*

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	4.138	4.138	5.524	0.026
Residual	30	22.473	0.749		
Total	31	26.611			

Table 3  
*Regression Coefficients for Pace of Work*

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	4.287	0.555	7.718	1.306E-08	3.152
Career Commitment	0.294	0.125	2.350	0.026	0.039

The resulting regression model is,  $y = 4.287 + 0.294 x_1$ . Therefore, a 1-unit change in career commitment should result in an average change of 0.2938 in pace of work. An F-test was conducted to evaluate the significance of the model. The ANOVA output provides a calculated F-value of 5.524. The critical F-value at a significance level of 0.05 is 4.171. Thus, as the calculated F-value is greater than the critical F-value, it was determined that the model was significant in predicting worker behavior for pace of work at a given alpha level of  $\alpha = 0.05$ .

These results indicate that the more committed an employee is to their career, (i.e. the more they like their job), the better their pace of work will be. These results also loosely support the authors' first hypothesis as the career component of occupational commitment is shown to significantly affect pace of work. This confirms the results of Balsler et al. (2012) where worker commitment to their union and occupation were both shown to relate to improved jobsite behaviors.

### *Correlation Analysis*

All three predictive models for the separate parameters of worker behavior showed little to no significance with the exception of the relationship between worker commitment to their career and pace of work. To rule out any potentially significant relationships that may have been missed in the regression model evaluation process, the authors performed a correlation analysis for all responses in the survey. This analysis revealed two relationships of interest to the study.

The first relationship of interest was the impact the frequency of boss initiated budget conversations had on foreman effort. The final question on the knowledge scale asked respondents to indicate the frequency with which their boss initiated conversations about the project budget. When comparing these responses with the behavior scale, it was revealed that foremen who indicated that their boss initiates more frequent conversations about the budget do not try to accomplish as much as possible each day. Thus, there was a negative relationship between frequency of boss initiated conversations and a foreman's effort to accomplish as much as possible in a given day. An F-test revealed this relationship to be significant at a given alpha level of  $\alpha = 0.05$ . Table 4 displays the ANOVA output.

Table 4  
*ANOVA Output for Behavior vs. Boss Initiated Budget Conversations*

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	7.861	7.861	5.601	0.025
Residual	30	42.107	1.404		
Total	31	49.969			

If the foreman is exhibiting resistance to the control placed over him by the frequency of conversations initiated by his boss, the relationship may confirm Hodson's (1999) assertion that workers will resist management as management begins to exert more control over the work. However, this relationship may simply be the result of the boss adjusting their management style for the foremen in question as they may be known already to accomplish less than other foremen. This is also just one response in a group of responses that otherwise revealed no other worker resistance across the other measures for behavior.

A second relationship of interest was the effect of one of the common rewards used in construction. Breaking the incentive use scale down into the individual responses revealed that the more a boss takes a foreman to lunch to express their appreciation, the greater the foreman's commitment to the employer. This was exhibited on average across all measures for employer commitment. An F-test revealed this relationship to be significant at a given alpha level of  $\alpha = 0.02$ .

Table 5

*ANOVA Output for Lunches with Boss vs. Commitment to Employer*

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	9.408	9.408	6.663	0.015
Residual	30	42.356	1.412		
Total	31	51.764			

While the lunches themselves may not be responsible for the increased commitment to the organization by the employee, they may present an opportunity for open communication between the boss and foreman. As stated by one of the Project Managers interviewed for the study, "We could talk about the job the whole time and not really realize it, but that is where I am getting a lot of the good feedback because they're not surrounded by the job."

## Conclusion

Neither the qualitative nor the quantitative data gave evidence for a positive relationship between a foreman's knowledge of the project budget and improved jobsite behaviors. Regardless of the findings, however, the budget remains the sole tool for monitoring and tracking the financial performance of a project. The budget is also the only tool for communicating with foremen the productivity and financial goals of the project. Whether it be the hours allotted for a work activity or a unit of output per crew hour, every project manager interviewed for this study stated that they provided the budget goals to the foremen through some means.

Unfortunately, this wealth of information is received with a level of distaste by some foremen who refer to the budget as, "the perfect world scenario" or a "bad word." The lack of an effect from providing the budget information to foremen also suggests a disconnect between the information provided and the actions taken in the field. This disconnect may be due to the goals of the foreman not aligning with the goals of the project manager. It is the belief of the authors that in order to align their goals, the means of communicating the goals or the tools for interpreting the budget must change.

One suggestion would be to have the foreman participate in estimating the project they will be running. This of course is a perfect world scenario as it is not always possible to plan during the bidding process who will run a job, but it at least exposes the foreman to the estimating process. The foreman can learn about the challenges of winning a competitively bid project, and a better estimate can be developed by having the forethought of the person doing the job incorporated into the estimate from the start.

A second suggestion would be to incorporate an estimating and budgeting training into either the apprenticeship program or a foreman training program. By training foremen upfront that part of their job is to interpret and develop

a plan to achieve the budget goals, they may be more likely to approach the project from a financial mindset as well as one of quality and workmanship. This however may need to be company a led effort rather than union training as every company is different. After all, not every company provides budget information and the extent and type of information provided to foremen is often dictated by the project manager running the job.

## References

- Argyris, C. (1952). *The impact of budgets on people*.
- Balsler, D. B., & Winkler, A. E. (2012). Worker behavior on the job: A multi-methods study of labor cooperation with management. *Journal of Labor Research*, 33 (3), 388–413. doi: 10.1007/s12122-012-9133-1
- Cherrington, D. J., & Cherrington, O. J. (1973). Appropriate reinforcement contingencies in the budgeting process. *Journal of Accounting Research*, 11 (1973), 225–253.
- Chong, V. K., & Chong, K. M. (2002). Budget goal commitment and informational effects of budget participation on performance: A structural equation modeling approach. *Behavioral Research In Accounting*, 14, 65–86.
- Coffey, M., & Langford, D. (1998). The propensity for employee participation by electrical and mechanical trades in the construction industry. *Construction Management and Economics*, 16 (5), 543–552. doi: 10.1080/014461998372088
- Cox, R., Raja, I., & Frey, A. (2006). Proposed subcontractor-based employee motivational model. *Construction Engineering and Management*, 132 (2), 152–163. doi: 10.1061/ASCE0733-93642006132:2152
- Hodson, R. (1999). Organizational anomie and worker consent. *Work and Occupations*, 26 (3), 292–323. doi: 10.1177/0730888499026003002
- Hodson, R. (2002). Worker participation and teams: New evidence from analyzing organizational ethnographies. *Economics and Industrial Democracy*, 23 (4), 491–528.
- House, R. J. (1971). A path goal theory of leadership effectiveness. *Administrative Science Quarterly*, 16 (3), 321–339.
- Hughes, S. W., Tippet, D. D., & Thomas, W. K. (2004). Measuring project success in the construction industry. *Engineering Management Journal*, 16 (3), 31–37.
- Lafferty, R. (2007). Measuring business performance through budgeting. *Journal of Construction Accounting and Taxation*, 17 (1), 44–46.
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 16 (2), 370–396.
- McGregor, D. (1957, 11). The human side of enterprise. *Management Review*, 41–49.
- Meyer, J. P., Allen, N. J., & Smith, C. A. (1993). Commitment to organizations and occupations: Extension and test of a three-component conceptualization. *Journal of Applied Psychology*, 78 (4), 538–551.
- Milani, K. (1975). The relationship of participation in budget-setting to industrial supervisor performance and attitudes: A field study. *The Accounting Review*, 50 (2), 274–284.
- Ouchi, W. G., & Jaeger, A. M. (1978). Type z organization: Stability in the midst of mobility. *Academy of Management Review*, 3 (2), 305–314. doi: 10.5465/AMR.1978.4294895
- Patchen, J. (1987). The manager of humans. Unpublished doctoral dissertation.
- Pink, D. H. (2009). *Drive: The surprising truth about what motivates us*. New York, NY: Riverhead Books.
- Spector, P. (1994). Using self-report questionnaires in ob research: A comment on the use of a controversial method. *Journal of Organizational Behavior*, 5 (5), 385–392. doi: 10.1002/job.4030150503
- Tippet, J., & Kluvers, R. (2009). Employee rewards and motivation in non profit organisations : Case study from australia. *International Journal of Business and Management* (2003), 7–14.
- Tsehayae, A. A., & Fayek, A. R. (2014). Identification and comparative analysis of key parameters influencing construction labour productivity in building and industrial projects, 891 (1), 878–891. doi: 10.1139/cjce-2014-0031
- Wen, Y., & Chan, A. (2014). Critical review of labor productivity research in construction journals. *Journal of Management in Engineering*, 30 (2), 214–225. doi: 10.1061/(ASCE)ME.1943-5479.0000194