Understanding the Role of Social Rules in Shaping Construction Workers’ Absence Behavior Using Agent-based Modeling and Surveying

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ABSTRACT

Construction workers’ absenteeism can significantly damage project performance, but the complex nature of absence behavior does not offer a simple explanation for this phenomenon. We have very limited knowledge, in particular, of the social aspect of construction workers’ absence behavior (e.g., social norms, social influence, and absence culture), which has been found to be an important factor in shaping employees’ behavior in organizations, but has often been overlooked by construction managers. Therefore, more studies on this social aspect of construction workers’ absence behavior are warranted, especially, for designing interventions for absence behavior on projects if needed. In this research, the relationships between workers’ perception/attitudes and their absence behavior are investigated using a mixed-research methodology incorporating agent-based modeling and surveying. Using this methodology, we have found that high levels of social adaptation can be a cause of a low absence level in work groups, particularly when workers have a high level of strictness in self-regulation, because social norms of low absenteeism can emerge in this condition and are reinforced by low levels of peers’ absence over time. With this result, it is suggested that construction managers foster favorable social norms in groups rather than focus only on formal rule enforcement targeting individuals.

BACKGROUND

Due to construction processes’ dependence on labor activities, absenteeism on a job site can significantly damage project performance in many ways, including interrupting workflow and reducing labor productivity, which, in turn, can result in serious revenue loss on a project (Hinze et al 1985). Although workers’ absence level can vary by the regional economic condition, it is not uncommon for construction projects to face problems concerning workers’ absence levels of 6%–10% (Hanna et al. 2005; Sichani et al. 2011). However, the complex nature of absence behavior does not allow for a simple explanation of this phenomenon.

Traditionally, construction managers have tended to see workers’ absence as an individual’s behavior that is primarily determined by individual factors, such as personality, personal morale, and personal situations/conditions (e.g., injury, illness, and family emergency) (Ahn et al. 2013a; Hanna et al. 2005). Perhaps that is why construction managers have tried to solve absence problems by focusing on those...
individuals who present excessive absenteeism, and by exercising formal controls on these individuals, such as penalties, suspension, and dismissal (Sichani et al. 2011). However, this kind of individual-oriented formal rule enforcement often turns out to be insufficient to improve workers’ attendance motivation (Sichani et al. 2011). From this, it may be inferred that there are other factors that affect workers’ absence behavior. Further, imposing frequent regulations may inadvertently fortify a culture that works against the projects’ interests.

Among the factors that would affect employees’ absence behavior, the social aspect of absence behavior in organizations (e.g., social norm, social influences, and absence culture) has recently drawn increasing attention (Johns 2008). Absence culture implies that employees perceive social norms concerning absence and then control their absence behavior accordingly (i.e., the social control of absence behavior) (Rentsch and Steel 2003). This social aspect of workers’ absence behavior has often been overlooked by construction managers, and the lack of knowledge could be one of the reasons for the difficulties faced in reducing absenteeism on those projects that suffered from it. However, the existence of social control of absence behavior does not always create a challenge, but can also pose an opportunity for construction managers; once a favorable social norm is established in work groups, workers’ absence can be rather autonomously maintained at a low level without managers’ costly efforts to control it. Further, social control of workers’ absence behavior implies that the nature of the control is not coercive, thereby meeting the least resistance to organization. That being the case, understanding the role of social rules in shaping workers’ absence behavior is very important. With this background, the objective of this research is to identify the relationships between workers’ perception/attitudes toward formal/social rules and their absence behavior.

PROPOSED METHODOLOGY

One of the most common empirical research approaches used to study organizational behavior is cross-sectional analysis with the data collected by a “snapshot” survey from a sample of employees. However, this approach is often criticized as inadequate to extend our knowledge of the dynamic processes that are the underlying mechanisms of human behavior (Seitz 2000). From this background, computational modeling and simulation has emerged as a new research tool to study the complex dynamics involved in human behavior (Seitz 2000). Computational modeling and simulation is helpful for understanding the dynamic processes of organizational behavior that unfold over time, and helps explain what we observe in reality, and therefore, ultimately, can help to design organizational interventions to guide organizational members’ behavior.

However, using computational modeling in human behavior research is not easy, and researchers may face many issues with respect to the credibility of the model. This is because human behavior is complex and uncertain, and therefore difficult to formalize as a simple model. With an aim to maximize the credibility and usefulness of computational models, an integrative, mixed research methodology incorporating agent-based simulation and surveying has been proposed and used in this research.
The proposed methodology is comprised of several research activities, as shown in Figure 1. The research begins by creating a theory-based, general agent-based simulation model (i.e., *Primitive modeling*). A primitive model can be created by translating existing theories into the computational behavior rules of agents (Hulin and Ilgen 2000). Then, this general model turns into a specific model with specific input parameters (i.e., *Configuration*). To create a specific model, existing empirical data provided by literature can be used to set input conditions. This research process involves an iteration of simulation runs and re-configuration (i.e., *Thought experiment*).

Another thread in the methodology proposed in this research is the survey and the survey data analysis. The hypotheses can be driven from the theory-based, general simulation model. With an aim to test the hypotheses, a survey questionnaire is developed and data is collected using the questionnaire (i.e., *Data collection*). Prior to any kind of statistical analysis, the collected data can serve as a comparison basis for simulation inputs and outputs (Eason et al. 2007). Since most of the input values for the simulation model of this kind are originally made with assumptions, the surveyed data is highly valuable in creating a specific simulation model that corresponds to the current reality. The translation of survey data into values that can be compared with simulation inputs and outputs may be necessary in this step. It should be noted that usually the survey data will be helpful for increasing the simulation model’s credibility for a particular area in the entire model output area, called “possibility space” (Hulin and Ilgen 2000), because the survey data can be seen as empirical evidence for a certain region in the possibility space. As a next step, data can be analyzed using traditional statistical methods, such as regression, to test the hypotheses that were created from observations on the simulation model (i.e., *Statistical analysis*). Since the hypotheses are related to the simulation outputs, the results of survey data analysis can be used to confirm the interpretation of the simulation results. After this step, researchers can have an increased confidence with the specific simulation model that corresponds to a specific reality. Then, researchers can do more thought experiments with this model to design organizational interventions for the specific reality.

**Figure 1. Flow diagram of proposed methodology**
RESULTS

As a first step in the proposed methodology, we created an agent behavior rule by translating Bandura’s (1991) social cognitive theory of self-regulation (i.e., *Primitive modeling*). The resulting agent behavior rule represents several perceptive/behavioral steps involved in a worker’s decision to attend work, including observing peers’ behavior, perceiving a social norm, formulating a personal standard based on the perceived social norm and formal absence standard, and making a decision to attend or not based on the personal standard at each time step (Ahn et al. 2013a). The agent behavior rule was formalized as a set of mathematical equations to be used for computer simulations.

Then the simulation model was specified with many hypothetical inputs (i.e., *Configuration*). The research question that was asked at this stage of the research was whether or not the absence rate will increase/decrease over time by different levels of social adaptation, formal rule adaptation, and strictness in the self-regulation of workers. To address this question, we applied a range of values for those variables and ran the simulation for 300 time steps (i.e., simulated days) to see the absence rate’s pattern change over time (i.e., *Thought experiment*). The results are shown in Figure 2. With these results, we concluded that high levels of social adaptation may result in a low absence level in the group, particularly when workers have a high level of strictness in self-regulation, because social norms of low absenteeism can emerge in this condition and are reinforced by low levels of peers’ absence over time. (Ahn et al. 2013a).
Then, a survey questionnaire was developed to collect the data that would be used to test these two hypotheses: “Construction workers’ perceptual and attitudinal variables toward formal controls will be significant predictors of their absence behavior” and “Construction workers’ perceptual and attitudinal variables toward social controls will be significant predictors of their absence behavior” (Ahn et al. 2013b). These hypotheses were developed to help validate our interpretation of the simulation model: “Individuals’ awareness of social rules can be as effective as the awareness of formal absence rules either for maintaining a low level of absence or for reducing their absence level over time.” To collect the data, three construction sites were selected in Ann Arbor, Michigan, US, and a total of 174 valid responses were collected (i.e., Data collection).

As a next step, a series of statistical analyses were conducted to confirm the findings of the simulation research (i.e., Statistical analysis). As shown in Table 1, it was found that construction workers who perceived salient social norms in their team were less likely to be absent from a job site, which implies that worker absence
behavior is under the influence of social controls, and that those who care more about the social norms present lower absence levels (Ahn et al. 2013b). Also, it was empirically found that while social control of absence behavior is effective, when high formal rule awareness is combined, absenteeism can be maintained at an even lower level, which also corresponds to the simulation results (Ahn et al. 2013b).

### Table 1. Results of Logistic Regressions Predicting Absence Level

<table>
<thead>
<tr>
<th>Variables in the model</th>
<th>B</th>
<th>S.E.</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived salience of social norms</td>
<td>-1.061</td>
<td>.301</td>
<td>.000</td>
</tr>
<tr>
<td>Perceived explicit social control</td>
<td>.990</td>
<td>.380</td>
<td>.009</td>
</tr>
</tbody>
</table>

Model Summary

<table>
<thead>
<tr>
<th>-2 Log likelihood</th>
<th>Nagelkerke R²</th>
</tr>
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<tbody>
<tr>
<td>156.311</td>
<td>.156</td>
</tr>
</tbody>
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Note. N = 140 (34 cases among the total of 174 were not included in the analysis due to missing data); B = maximum likelihood regression statistic; S.E. = standard error; Sig. = significance level.

**CONCLUSIONS**

Using the proposed methodology, we have found that high levels of social adaptation can be a cause of a low absence level in work groups, particularly when workers have a high level of strictness in self-regulation. This is because social norms of low absenteeism can emerge in this condition, and they are reinforced by peers’ low levels of absence over time. With this result, it is suggested that construction managers foster favorable social norms in work groups (i.e., crews) rather than focus on formal rule enforcement targeting individuals. As mentioned previously, the existence of the social control of absence behavior can pose an opportunity from the perspective of worker behavior management. Once a favorable social norm is settled in the work groups in a project, construction managers would not need to make costly efforts to maintain the favorable worker behavior. Further, it is expected that workers’ resistance to the control will be minimal because social norms are “their rules” that emerge from workers’ social interactions. In contrast, in coercive organizations workers may conform to the formal rules due to fear, but may develop norms that are against the organization’s interest. To maintain workers’ favorable behavior in this type of organization, managers may have to keep putting in effort to control workers’ behavior with external forces.

The simulation model should correspond to the exact reality in the moment in order to be used as a tool to design and test organizational interventions. To make a specific model that exactly corresponds to the current reality, we can use the surveyed data. We have found that workers from the sites participating in our survey, in general, have a low level of formal rule adaptation, a medium to high level of social rule adaptation, and a very high level of strictness in self-regulation. This information
can be used as input to create a model that can generate simulation outputs that correspond to the workers’ current behavior, and this specific model can be used to develop organizational interventions to effectively and efficiently prevent excessive absenteeism in the near future under the current condition.

The credibility of an agent-based model for human behavior research can be dramatically increased when the simulation inputs and outputs correspond to the reality, and when the patterns observed from simulations correspond to the patterns that we can observe in the reality. In order to increase the credibility and usefulness of the simulation modeling, we proposed a mixed research methodology, and we studied the relationship between workers’ perception/attitudes toward formal/social rules and their absence behavior using the methodology. Since the pattern observed from simulations—the social control of workers’ absence behavior can reduce absenteeism when workers have high levels of strictness in self-regulation—was supported by the result of survey data analysis, the simulation model’s credibility was increased, at least, for the region in the simulation output space that represents a situation where workers’ present a very low level of absenteeism as a result of high levels of social adaptation and high levels of strictness in self-regulation. In this way, the proposed mixed research methodology can be useful for researchers who study organizational behavior using computational modeling.

The next step in this research would be to develop organizational interventions for workers’ absence behavior that are most suitable to the current state of organizations. Since the role played by social rules in shaping workers’ absence behavior has been identified, this knowledge can be used to design interventions to reduce absence behavior on construction projects if there is a need for such efforts. For example, sometimes managers might want to promote cohesion in workgroups so as to maximize the effect of social rules on absence behavior, or, some other times, managers might want to promote the independence of each member’s behavior.

REFERENCES


