Frontiers in Public Management
ISSN Print: 3104-4441
ISSN Online: 3104-445X
CD ISSN: 3104-4468
https://doi.org/10.63313/FPM.9019

Formal Randomness and Perceived Fairness in Workshop Work Order Allocation

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How to cite this paper: Chen, M. (2026). Formal randomness and perceived fairness in workshop work order allocation. Frontiers in Public Management, 2(1), 31–41. ISSN Print: 3104-4441, ISSN Online: 3104-445X.
https://doi.org/10.63313/FPM.9019
Published: 2026-10-20

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Abstract

Resource allocation in grassroots organizations is often assumed to be acceptable to members as long as the results are broadly balanced. This study uses the work order allocation in the packaging workshop of a stationery manufacturing company as the scenario, and conducts three waves of questionnaire surveys among the same group of workers, with 57 people in each wave. The supervisor allocation was rejected with near consensus, and the focus was that the rules could be used; the random form of paper lottery was approved, but the actual implementation was not trusted. The second wave showed that rule breaking is not merely an attitude: more than 80% of workers had seen an order successfully swapped at least once in the past year, and workers who chose rigidity had significantly higher expectations of the system. The third wave showed that once the system was connected to scheduling, workers' general judgement about rule consistency did not move, while the reassurance brought by rigidity and the expectation of accommodation in special circumstances fell markedly. Based on this, this study proposes that formal randomness itself is not enough to establish perceived fairness. Whether the rules can be artificially broken is the key, and workers' preference for rigidity may be a choice under the condition that discretion has been repeatedly used.

Keywords

Procedural Justice; Perceived Fairness; Rule Breakability; Algorithmic Management; Work Order Allocation

1. Introduction

1.1. Background

Resource allocation in grassroots organizations is a long-standing management problem. A common assumption is that as long as the allocation results are generally balanced, members will accept it, but the actual situation on the shop floor is often not the case. The scenario of this study is the work order allocation in the packaging workshop of a stationery manufacturing company: the supervisor

allocation orders based on experience and subjective judgment. The paper lottery determines the ownership by paper lottery but the result can still be adjusted by the supervisor afterwards. The system introduced thereafter algorithmic allocation, the rules are fixed and do not accept replacement. After the switch to the paper lottery, approval of the allocation method improved, but the conflict was not resolved.

1.2. Research questions

This study attempts to answer three questions. What is the difference in workers' perceived fairness among the three distribution methods? What is the reason if formal randomness fails to establish a stable perceived fairness? How will workers' trade-off between rigidity and flexibility change when the rules truly cannot be broken.

2. Related Work

Research on procedural justice began with experimental comparisons of dispute resolution procedures: parties' evaluation of the procedures will affect their acceptance of the results, even if the results are unfavourable [1]. Subsequent research has dismantled the evaluation criteria of procedural justice into several rules, of which consistency is only one, alongside representativeness and correctability. Voice has also been divided into instrumental and expressive functions [2][3][4][5], and interpersonal treatment constitutes another independent source of justice [6]. Unchangeable rules have a high score on consistency but may score low on correctability; if the two are regarded as the same construct, workers' positive and negative evaluations of rigidity will cancel each other out [7][8].

Attribution theory provides another clue. When negative results are attributed to human decision-making, it is easy to produce targeted judgments, whereas when they are attributed to a mechanism without subjective will, they are more likely to be accepted as luck [9]. Depersonalization may therefore affect the level of conflict by changing the attribution object.

Research on algorithmic management shows that while algorithms improve consistency, they can also lead to concerns about individual situations being ignored [10]. The opacity of allocation rules makes it difficult for workers to judge whether the rules are consistently implemented [11], and the way the rules are implemented is more predictive of acceptance than the rules themselves [12][13]. The comparison between algorithms and manual judgment is equally divisive as people trust algorithms more in most tasks that only require judgment [14], but quickly turn to human judgement once they see the algorithm err [15]. Most of the existing research comes from experimental situations and platform labour, and lacks evidence from workshop production sites.

3. Method

3.1. Study Design

The research setting is the packaging workshop of a stationery manufacturing company, with more than fifty workers. Supervisor allocation assigns orders by experience and subjective judgement, and workers can approach the supervisor to negotiate a swap; paper lottery determine the ownership of work orders by paper lottery, but the results can still be adjusted by the supervisor afterwards; the algorithmic allocation orders based on random rules, and the rules are fixed and do not accept replacements.

3.2. Participants

Questionnaires were all administered to the same group of workers. In each wave, 57 copies were issued and recovered, one for each person, and there was no duplicate filling in, covering all employees on duty in the workshop. The first wave consists of 18 people who have worked in the workshop for less than 1 year, 17 people who have worked in the workshop for 1 to 3 years, and 22 people who have worked in the workshop for more than 3 years. The difficulty level of daily work is mainly medium.

Table 1. Design of the three questionnaire waves

Waves	System status	Measurement content
first wave	Not connected to schedule	Evaluation of supervisor's experience, expected judgment of the system, and overall perception of procedural justice
second wave	Not connected to schedule	Distributive fairness, voice, forced choice between rigidity and flexibility, experience of the old system, expectations for the system
third wave	Accessed to schedule	Expectation versus experience, cost of rigid rules, system usage

3.3. Measures

All three waves used self-compiled questionnaires with five-point Likert items. The first wave includes 2 basic information questions, 21 Likert questions and 2 open questions; the second wave has a total of 19 questions, and is a supplementary test; the third wave has a total of 17 questions, measuring judgments after the system is running.

3.4. Analysis strategy

In the first wave, each subject responded to the three allocation methods, and the data formed a paired structure. When the two methods of personal experience were involved, the paired method was used, including McNemar's exact test and Wilcoxon signed rank test, and the correlation between items was estimated by Spearman's rank correlation. For the second wave, the Wilcoxon signed-rank test was used to compare the two items on voice, and the independent sample t test was conducted using forced-choice grouping. There is no correspondence between the second wave

and the third wave at the individual level, and comparisons are made at the group level: items with verbatim same questions are tested using independent samples t, and items with different questions only read in the direction.

3.5. Ethics

The questionnaire is designed to be anonymous. Only the answer sheet numbers are retained in the analysis data. All three waves of questionnaires were distributed by the researcher at the workshop. Before distribution, the purpose of the research and anonymity were explained and informed consent was obtained.

4. Results

4.1. Data quality and descriptive statistics

In each of the three waves of questionnaires, 57 valid answers were collected, one for each person, and there was no duplication of responses. Among the six items on supervisor allocation, only two questions, "Fair to all workers" and "Able to accept the results calmly," were dominated by disagreement. The agreement rates were 5% and 7% respectively. Agreement with the remaining four items was above 86%. The paper lottery block is the most divided: the agreement rates for the two questions "The allocation method is fair" and "Trust in this method" were only 44% and 47%, while the two questions "Orders can still be swapped after the lottery" and "The rules were not strictly enforced" were 86% and 91% respectively. Agreement across the six algorithmic allocation items ranged from 86% to 96%.

4.2. Evaluation of supervisor allocation

Supervisor allocation was the only system among all the items that was rejected by a near consensus. Only 3 people (5.3%) believed that it was fair to all workers, and only 4 people could accept its results calmly. However, the agreement rate for the four items that there were favouritisms, unfairness in the distribution of difficult jobs, easy to cause disputes, and unstable rules were all above 86.0%. Negation is not directed at the result itself, but rather focuses on the fact that the rule can be exploited.

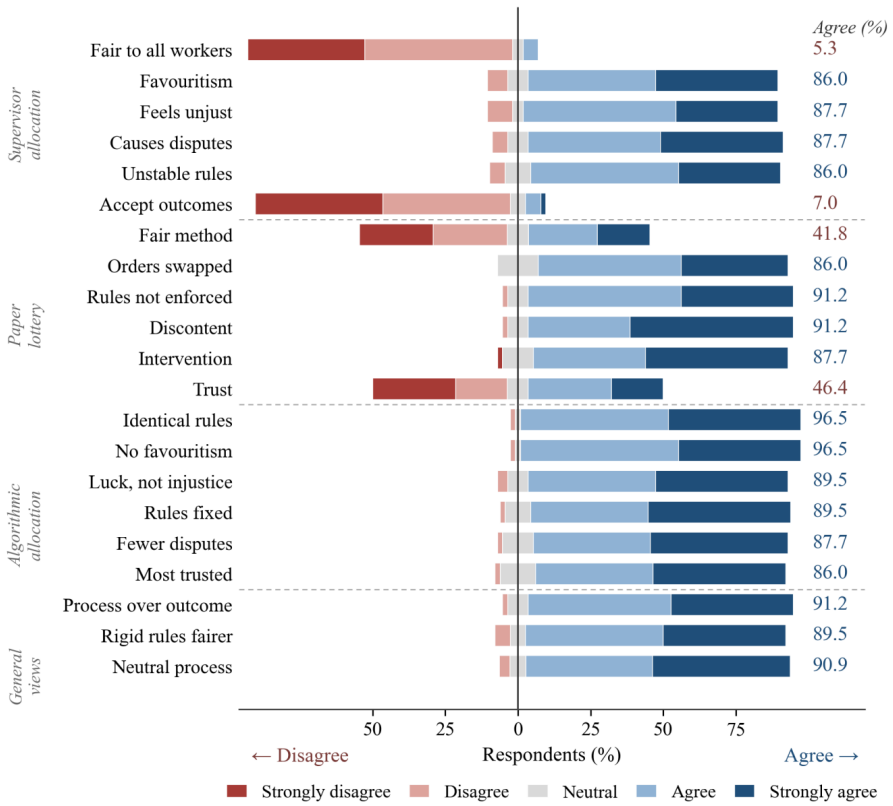


Figure 1. Five-point response distribution for the 21 first-wave items (N = 57)

4.3. Evaluation of the paper lottery

41.8% believed that the paper lottery method was fair, and 46.4% expressed trust in this method; at the same time, 86.0% admitted that after the paper lottery, someone could still order swapping through the supervisor, and 91.2% believed that the rules were not strictly enforced. Workers accepted the random format of the paper lottery but distrusted its actual execution. 22 workers moved from not endorsing supervisor allocation to endorsing the paper lottery, and only 2 moved the other way. McNemar's exact test $p = 3.588 \times 10^{-5}$; a Wilcoxon signed-rank test paired trust in the paper lottery with calm acceptance of supervisor allocation; $n = 56$, $z = -4.198$, $p = 2.764 \times 10^{-5}$, effect size $r = 0.561$.

4.4. Tenure and the evaluation of the paper lottery

There is a significant negative correlation between tenure and paper lottery evaluation, while the correlation with supervisor allocation evaluation and algorithm system evaluation is close to zero (Figure 2). The fairness of the paper lottery dropped from 3.71 to 3.00 and then to 2.05 in the three groups of tenure, Spearman $\rho = -0.469$, $p = 0.0003$; trust in the paper lottery fell from 3.50 to 3.31 and

then to 2.09, ρ = −0.392, p = 0.0028. If this were just a general attitudinal tendency, then it should appear in multiple dimensions at the same time, which is not the case.

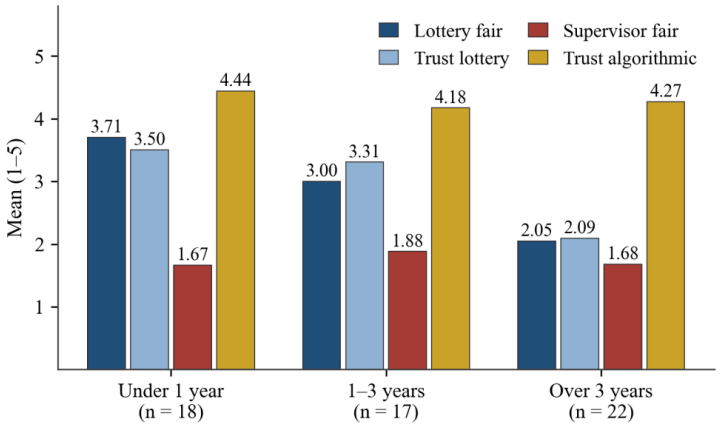


Figure 2. Tenure and each indicator

4.5. Expectations about the algorithmic system

After watching the demonstration and operating the system themselves, workers were highly consistent in their judgment of the system. The agreement rates for the six questions ranged between 86.0% and 96.5%, with the two questions of consistent rules and lack of favouritism being the highest, both at 96.5%.

4.6. Experience of rule breaking and the trade-off over rigidity

The second wave uses empirical methods to measure the extent to which rules have been broken. 80.7% of workers (46 people) had seen someone successfully replace assigned work orders at least once in the past year, and 56.1% (32 people) of them had seen it three or more times. The trade-off between rigidity and flexibility was measured by a two-choice question: 38.6% chose negotiable and adjustable but sometimes influenced by favouritism, and 61.4% chose not adjustable at all but never favouritism. Workers who chose the rigid side had significantly higher expectations of the system (Figure 3). By the third wave the share choosing the rigid side had fallen to 45.6%, 15.8 percentage points lower than in the second wave.

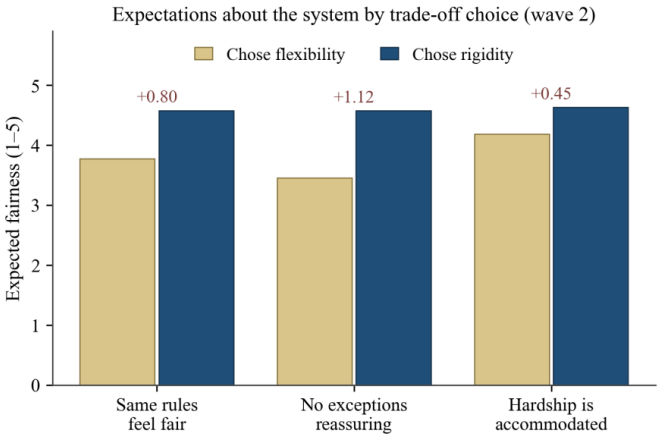


Figure 3. Expectations about the system by trade-off choice (wave 2, N = 57)

4.7. Expectation versus experience

Questions 1 and 2 of the third wave are word-for-word identical to questions 15 and 16 of the second wave, forming a comparison that can be compared question by question across waves. The means of the two items barely moved: "Being assigned according to the same set of rules makes me feel fair" dropped from 4.26 to 4.21, and "Not being able to make anyone an exception makes me feel secure" dropped from 4.14 to 3.93, both of which are not significant. Workers' general judgement about rule consistency therefore holds after the system was connected to scheduling.

The two rewritten items declined clearly. The second wave asked "I hope the system can still take care of me when I feel unwell or have trouble at home", with an average value of 4.46. The third wave asked "During this period, I have experienced physical discomfort or trouble at home, but the system did not take care of me", with a mean of 3.68. The sense of solidity brought about by rigidity dropped from 4.14 to 3.44.

4.8. Judgements after the system went into operation

After the system is connected to the shift schedule and runs for a complete work order cycle, the evaluation takes a composite form. The rules are understandable: 66.7% said they knew clearly what rules the system follows, 68.4% understood better why they received a particular order, 66.7% needed to consult others less, and 59.6% thought there were fewer quarrels in the workshop than before. At the same time, the cost of rigidity has also appeared: 59.6% admitted that the system did not take care of them when they were feeling unwell or had trouble at home, 45.6% said they had to find a way to do the work they couldn't do, and 70.2% still hoped to be able to adjust when they were assigned difficult tasks. 73.7% had taken on more than 20 orders through the system and only one had never used it; 68.4% found the orders assigned by the system about the same as before and 21.1% found

them heavier.

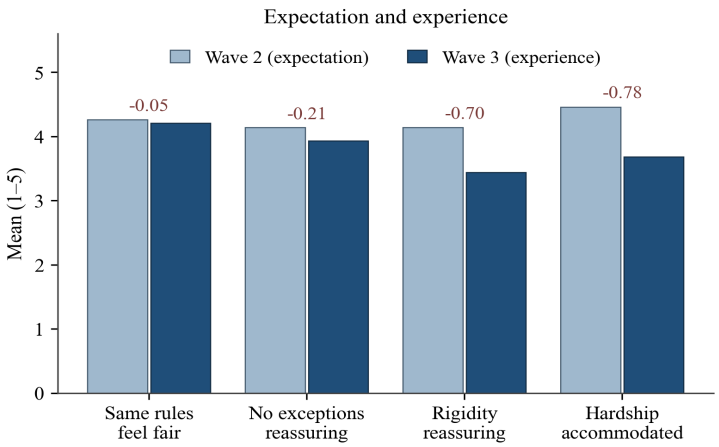


Figure 4. Expectation and experience

4.9. Material from the open-ended items

In the first round, most respondents preferred automated dispatch, citing as their main reason that assignments are not influenced by personal relationships.

In the second wave, 53 out of 57 respondents explicitly preferred automated dispatch. When asked how they would handle a situation where the system assigned a difficult order but they were genuinely unable to take it that day, 12 respondents chose to find a way to arrive early to complete the task, while the rest hoped the system would provide advance notice or make adjustments.

Regarding actual situations encountered after the system went live, 13 respondents mentioned that their requests to swap assignments were rejected, 28 completed their work through various means, and 8 reported that they privately swapped assignments with someone else. When asked what aspect needed the most improvement, advance notice and assignment based on proficiency were the main suggestions.

5. Discussion

5.1. Why formal randomness fails

The lottery system ensures randomness at the rule level, and workers acknowledge this; however, only 41.8% perceive it as fair. This is because workers believe the rules are not strictly enforced.

The second round of experience reports also supports this explanation. 80.7% of workers have witnessed someone successfully switching assignments at least once, and 56.1% have witnessed it three or more times; moreover, the longer a worker has been on the job, the more often they report having witnessed such incidents. The fact that the rules can be circumvented is reflected in specific, recurring

incidents.

5.2. The trade-off between flexibility and predictability

The four responses favouring supervisor-assigned tasks constitute a set of counterevidence, based on the argument that supervisor-assigned tasks can accommodate individual differences, a value trade-off that contrasts with the majority of responses. Fifty-one people preferred machine-assigned tasks, citing the neutrality of the rules; four preferred supervisor-assigned tasks, citing the flexibility of the rules. The immutability of the rules is seen by the former as a guarantee of fairness, while the latter view it as a source of neglect. In an environment where discretionary power has been repeatedly exercised, workers' trade-off between rigidity and flexibility tends to lean toward predictability, and in this workshop, flexibility lies in the hands of supervisors. This leads to a conditional proposition: the relative weight of consistency and correctability in the evaluation of procedural justice may depend on the degree of trust individuals place in the discretionary decision-maker.

Data from the second wave provides evidence for this proposition. Workers who chose the "rigid" side had expectations of system fairness 0.80 higher than those on the other side, and expectations that rigidity would provide a sense of security 1.12 higher. After the swapping channel was closed, the proportion of workers choosing the rigid side dropped from 61.4% to 45.6%, indicating that this preference depends on the premise that "flexibility is in someone else's hands", and once they themselves become the recipients of rigidity, their priorities shift.

5.3. Two possible outcomes of the expectation-experience comparison

The workers' evaluations of the two systems they had personally experienced showed marked differences, yet they gave highly consistent positive assessments of a system they had only seen demonstrated. A possible reason could be that the system had not yet been connected to actual scheduling at the time, so the responses lacked real experience.

A comparison conducted after the system went live distinguished between these two trends (Figure 4). The two questions with identical wording showed almost no change, indicating that workers' judgments regarding the consistency of the rules were stable. The two reworded questions, however, showed a clear decline, suggesting that the costs of rigidity are only perceived after actual experience.

6. Limitations

This study has limitations at three levels, including design, measurement, and data collection. In terms of design, the study is limited to a single workshop, and workers' evaluations of supervisors' assignment of orders and paper lottery are retrospective, and there is recall bias. In terms of measurement, the sample size is 57, which does

not support factor structure testing. In terms of data collection, the first wave of questionnaires was completed under conditions where workers could move around and communicate freely, and there was mutual influence on responses.

7. Conclusion

This study conducted three waves of questionnaire surveys in the same workshop. The first wave shows that supervisor allocation is rejected by near consensus, and the rejection focuses on the fact that the rules can be exploited; the random form of the paper lottery is recognised, but its actual execution is not trusted. To sum up, formal randomness is not enough to establish perceived fairness. Whether the rules can be deliberately broken is the key. Workers' preference for rigid rules may be a choice under specific conditions in which discretion has been repeatedly exercised, rather than a universal rule.

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