CHAPTER 11

ANALYSIS OF THE IMPACT OF CROSS-TRAINING ON EMPLOYEE SUSTAINABILITY WITH SIMULATION APPROACH

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INTRODUCTION

Sustainability is the ability to maintain a certain level, and in the Brundtland (1987) report it is expressed as *"meeting the needs of the present generation without compromising the ability of future generations to meet their needs"*. This universal definition indicates that sustainability focuses on the continuity of natural resources. On the other hand, sustainability emerges at the intersection of economic, social and environmental domains, and in this respect, it guides many derived concepts such as cultural sustainability, financial sustainability and environmental sustainability. Sustainable human resources management is one of them and is defined by Enhert, Parsa, Roper, Wagner and Muller-Camen (2016) as: *"the adoption of HRM strategies and practices that enable the achievement of financial, social and ecological goals, with an impact inside and outside of the organization and over a long-term time horizon while controlling for unintended side effects and negative feedback"*. This definition helps us set the sustainable human resources objectives as follows: i) contributing to the sustainability goals of the organization, ii) developing, renewing and maintaining the human resources of the organization, iii) monitoring the effects of human resources practices on employees and the organization and adapting them to changes. After a comprehensive research, Stankevičiute & Savanevičiene (2018) lists the characteristics of sustainable human resources management as follows; long-term orientation, care of employees, care of environment, profitability, employee participation and social dialogue, employee development, external partnership, flexibility, compliance beyond labor regulations, employee cooperation, fairness, and equality. If the definition, ob-

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jectives, characteristics of sustainable human resources management are considered together, employee sustainability appears as one of the main components of the concept. Thus, while employee sustainability focuses on improvements in job satisfaction, motivation, work-life balance, well-being, and employee turnover, it also considers economic sustainability. In short, it seeks ways to benefit from employees as much as possible by mutually benefiting from each other between employees and employers (Docherty, Kira & Shani 2008; Richards, 2018). Cross-training is emerging as a practice that supports employee sustainability, especially as an effective measure against employee shortages (Abuharris, 2014; Maxwell, Briscoe, Schenk & Rothenberg 1998; Muduli, 2013).

This chapter handles Employee Sustainability in terms of employee shortage and recalls cross-training to mitigate its negative effects. Its motivation can be stated as follows. The Covid-19 pandemic has once again brought up the importance of employee sustainability in labor-intensive sectors. The employee shortage, which was previously caused by reasons such as absenteeism and illness, reached insurmountable dimensions, up to the cessation of the operation, with the mandatory quarantine practices during the pandemic period. In addition to its positive mental impact on employees, cross-training is an effective management tool that human resources managers can use to combat employee shortages. The prominent benefits of cross-training include employee motivation, workforce sustainability, and productivity, while its disadvantages include competition, dissatisfaction, and loss of focus. Decision-makers are reluctant to act without determining the cross-training model in which they will gain the absolute advantage. An unsuccessful attempt can have difficult-to-recover consequences. This chapter demonstrates the evaluation of cross-training models by simulating, and the advantage of testing different models without incurring any cost or risk.

In the Section 2, the pros and cons of cross-training, as well as the benefits for the organization and the employee, are discussed. In the Section 3, cross-training policies are described, in a hypothetical hospital environment simulated, and compared. The importance and benefits of cross-training are emphasized in the last section.

CROSS TRAINING

This section discusses the pros and cons of cross-training from an employee and employer perspective in a regular organization. In a simple definition, cross-training refers to training the employee to work in several roles. Imagine for a moment that a key employee in a mission-critical role is unable to fulfill their responsibil-

ities for some reason. Were you intimidated by the chaos that could ensue? Well then, imagine that an employee in another role is being trained for this critical task and you can keep things going with that employee. Great operational flexibility, isn't it? Cross-training for similar scenarios acts as a disaster recovery plan. At first glance, although the organization seems to be the primary beneficiary of cross-training, it is the shortest way for employees to become more valuable to the organization. While organizations benefit from the benefits of cross-training only when necessary, employees begin to benefit from the moment they are involved in the practice.

The pros and cons of cross-training can be examined separately from the employee and employer perspective.

In terms of employer;

- Cross-training is an important instrument to reduce the operational continuity risk that may arise in the absence of a key employee.
- Cross-training can be thought of as a talent discovery process. It is an important opportunity for the hidden talents in the organization to show themselves or for the manager to discover these talents.
- Every employee makes the mistake of thinking that their job is critical to the organization. Only through cross-training can he recognize other tasks, grasp their importance, and notice details that he had previously overlooked.
- During cross-training, the host employee explains to the guest employee how things are done. Transparency during this forces the process to improve.
- The organization's adoption of cross-training as a culture is a reason for preference for employee candidates who want to constantly improve themselves. Thus, the organization is more preferable for talented and visionary employee candidates.

In terms of employees;

- Cross-trained employees are more valuable to the organization than others. Employers can offer attractive offers such as promotions, bonuses, and extra benefits to retain their cross-trained employees. In short, cross-training provides an opportunity for employees to grow and prosper quickly.
- Cross-training allows the employee to break their tedious work routine. Employees who participate in cross-training experience a decrease in boredom and stagnation, and an increase in productivity.
- Cross-training allows employees to acquire new skills, build social relationships.
- Employees realize the importance of different parts of the organization during

cross-training, enabling them to better understand the big picture.

If cross-training is not applied consciously, it brings with it many negativities. A poorly designed cross-training program will fill the organization with employees who do not specialize in one job and have little knowledge of each job. Cross-training becomes commonplace for employees and employers alike. When the employee sees that cross-training, which he is eager to improve himself and to be more valuable for the organization, becomes commonplace, he becomes discouraged, his motivation decreases, and his desire to leave the job increases. The employer cannot get the expected efficiency from the cross-training application, cannot turn the costs incurred into benefits, is perceived as unsuccessful in the eyes of the employees, and its reliability decreases. As a result, neither the employee nor the employer can enjoy the benefits of cross-training.

For this reason, employers are reluctant to cross-train without being sure of the absolute benefit. Being able to test the employer's cross-training application before it is implemented is motivating for the implementation of the cross-training. In this respect, it is important to simulate cross-training practices and to clarify the uncertainty for the employer, even a little.

This chapter focuses on testing different models and determining the most suitable model for the organization before the implementation of cross-training.

CROSS TRAINING POLICIES

This section introduces cross-training models. Four models introduced in the literature are considered: i) no cross-training, ii) full cross-training, iii) reciprocal cross-training, iv) chain cross-training.

No cross-training: Each employee works in only one unit. He did not receive training for other units.

Full cross-training: Every employee can work in any unit. All employees have received training to be able to work in all units.

Reciprocal cross-training: A certain number of units are matched with each other and a certain number of employees in these units receive training in the matched units.

Chain cross-training: The units are linked together in a chain. A certain number of employees in each unit receive training in the next unit from their own unit.

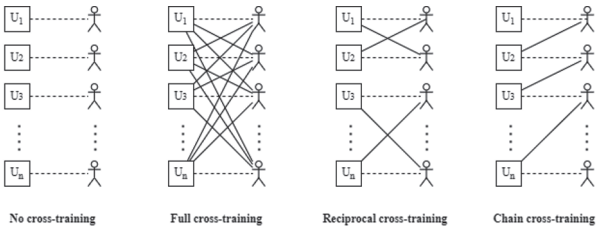

Figure 1. Schematic representation of cross-training models

SIMULATION MODEL

The above-mentioned cross-training models, which can be created in different variations, cannot offer the same success for every organization. Different dynamics of organizations will affect success. If the decision-maker puts into practice without testing which model is appropriate, it may not achieve the desired benefit and may suffer. The most appropriate cross-training model for the organization can be determined by trial and error, but this method is time-consuming and costly. An alternative method that is more attractive in terms of time and cost is simulation.

A simulation is a model that mimics the operation of a system, testing possible changes to the system, and providing evidence for decision-making. It is a cost-effective method that allows critical decisions to be investigated without risk. All possible condition changes on the system can be analyzed. On the other hand, creating a realistic simulation environment can be quite costly. To simulate a system requires extensive research and awareness of all relevant factors. It is seen that it has a very wide application area with various assumptions (Accorsi et al., 2022; Brailsford, Harper, Patel & Pitt 2009; Mishra, Kumar & Hassini 2019; Ridler, Mason & Raith 2022).

In order to examine the effect of cross-training models, it is sufficient to consider the relevant subsystem where the effect of the change can be observed, rather than the entire system. For this reason, the personnel-unit matching system, which determines only the unit where the personnel will work, is included in the simulation.

The basic assumptions of the simulation environment are:

a. Each unit has enough staff to have an optimal workload at full occupancy.
b. The occupancy rate of each unit is random.
c. Absenteeism of each staff member is random.

d. According to the cross-training model, each unit has cross-trained personnel who can work in different units.
f. If a unit has enough staff and cross-trained staff is on the job, it can support other units.
g. If the personnel workload is lower than the acceptable level, it requests cross-trained personnel from other units.
h. Demanding units are supported by compliant units according to personnel load.

The simulation algorithm in the study consists of two stages. In the first stage (Figure 2), staff workload is calculated within the framework of randomly determined unit density and staff absenteeism, and it is determined whether the unit can support another unit. In the second stage (Figure 3), it is determined which unit will support which unit.

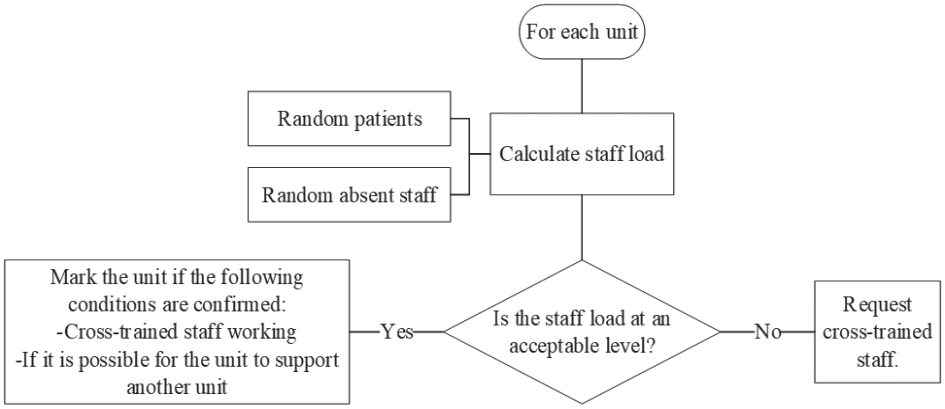

Figure 2. The first stage of the simulation algorithm

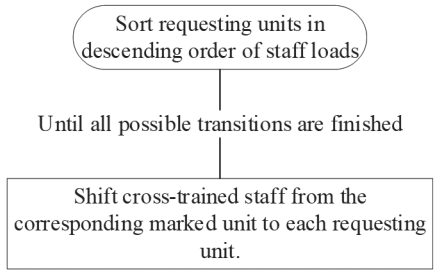

Figure 3. The second stage of the simulation algorithm

Comparison of cross-training models with simulation

In the study, we preferred a hospital setting consisting of six units to compare cross-training models. The hypothetical simulation environment is summarized in Table 1. In many parts of the world, the health sector is struggling with a shortage of staff. For this reason, the simulation data was created in this direction.

Table 1. Simulation Data

Units	Patient Capacity	# of staff	Ideal workload (patient/staff)
1	10	5	1
2	14	8	1
3	14	8	1
4	35	7	3
5	16	8	1
6	12	5	2

In the simulations, the number of patients and absent staff in the units were determined randomly. The number of cross-trained personnel in each unit is limited to 1. This is not a critical constraint. As the number of cross-trained staff increases, as emphasized in the previous sections, the importance of the cross-training practice disappears, and it banalizes. The scenarios were repeated a thousand times, and the performance of the cross-training models was measured by deviation from the units' ideal staff workload. Negative deviation in simulation results is important because it indicates an increased staff workload.

Table 2. Simulation Results

	Cross Training Models			
Units	No cross-training	Full cross-training	Reciprocal cross-training	Chain cross-training
1	-90,65%	-33,76%	-56,12%	-70,07%
2	-74,68%	-20,02%	-30,58%	-40,00%
3	-73,59%	-19,88%	-33,82%	-38,91%
4	-67,37%	-12,17%	-27,63%	-37,89%
5	-92,33%	-37,68%	-52,66%	-60,44%
6	-13,04%	19,12%	8,13%	-1,10%

Table 2 and Figure 4 show the simulation results. Accordingly, in the no cross-training model, it is seen that the staffs are overloaded. This situation may lead to an increase in medical errors and a decrease in the quality of the health service provided, as well as an increase in the dissatisfaction of the staff and their willingness to leave the job. On the other hand, in the full cross-training model, there is a remarkable decrease in the increase in the workload per staff member. Although it is not at the desired level, it can be said that it promises a better working environment to the staff. However, it should not be ignored that this model is quite costly. On the other hand, the full cross-training model is unrealistic. Because it is not practical for a staff to receive training in all units and work in other units when necessary. Although the reciprocal and chain cross-training models have lower performance than the full cross-training model, they can be preferred in terms of cost advantage. The similarity between units makes the reciprocal cross-training model more applicable in the hospital setting.

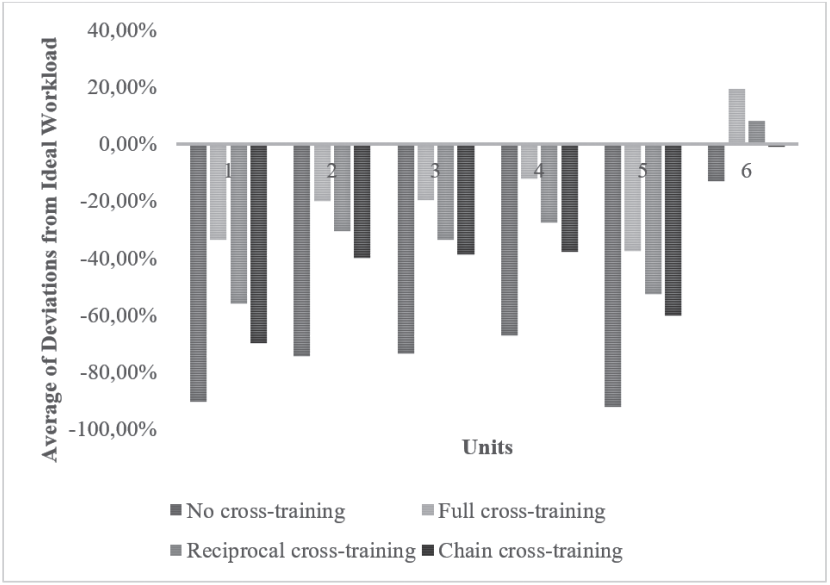

Figure 4. Simulation Results Graph

CONCLUSION

In this section, cross-training, which is an effective solution method for employee sustainability, is revisited. The cross-training practice, which is actively recommended against the lack of personnel in the literature and practice, has come

to the fore again with the Covid-19 pandemic. Mandatory quarantine practices have paralyzed organizations by taking ordinary absences to a higher level. The fact that employees in key roles cannot fulfill their jobs causes the butterfly effect. Exactly in such cases, having an alternative staff member who can do the same job is life-saving. Cross-training refers to the training of a staff member to perform other duties other than their main job. This application, which provides multidimensional benefits for employers and employees, is an important tool in ensuring employee sustainability. However, the cross-training model that is not suitable for the organizational structure may cause more harm than good. Therefore, decision makers do not want to take the risk of learning through trial and error which model is suitable for the organization.

In this study, it is aimed to show that a cross-training model suitable for the organizational structure can be determined by simulation method. Simulation is a decision model used by decision makers to determine how changes on the system will cause results. It is an ideal tool for analyzing the impact of cross-training models that are at the center of the study.

The simulation method proposed for the testing of cross-training models was applied in a hypothetical hospital environment, where staff shortages could cause vital problems. No cross-training, Full cross-training, Reciprocal cross-training, Chain cross-training models were tested in the simulated environment. The performance of the cross-training model was evaluated by measuring the deviation from the ideal workload of the units.

When the simulation results are examined, it is seen that the reciprocal model is more acceptable among the cross-training models. Although the full cross-training model performs better, it is a very costly and difficult to coordinate option in terms of practical implementation. In addition, it is unrealistic to train a staff who will receive cross-training in all units and to provide the desired service. In addition, the reciprocal model requires staff to be cross-trained to be trained in a limited number of units. This makes the model more applicable and logical.

The simulation method can be used by the decision-maker to determine the most appropriate cross-training model for the organization without taking the risks that may arise through trial and error. In this study, the advantages of the method and the benefits of cross-training were tried to be demonstrated by simulating a simple hospital environment.

In future studies, other factors related to cross-training can be included in the simulation, and the pros and cons of the application in different dimensions can be included in the analysis.

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