



# HOMSI, a Home-Office Model for the Software Industry in the Big Cities of Mexico

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**Abstract.** The Software Industry in Mexico (SIM) is accentuated in large cities. This industry requires thousands of employees who must go to the offices weekdays. However, mobility in large cities is increasingly complicated by two factors: the first is the distance from your residence to the office, that can be from 1 to 30 km away or more, on the other hand, the expenses caused by the transport. The means of transport can be from the worker himself or public transport as: metro, bus, “metrobus”, taxi, etc. In this work, a home-office model is proposed, which suggests that developers go once to the main office and the rest of the weekdays work from your home. The above, is not by default, because they must have the minimum conditions to work in his own house. However, when working in their own home there are benefits such as: saving time and money in the travel and on the other hand, the developer does not suffer stress caused by the daily travel. In the model, a central office is proposed for meetings and training. So that, each developer must have a space in her own home and adapted for a home office. The above, implies having an Uninterrupted Communication Medium (UCM) to be in contact between developers, as well as with the Couch (Co) and the Project Manager (PM). In the results, statistics of travel times and expenses, as well as the effects of traveling to work every day, are shown. We conclude that, the Home-Office Model can achieve more satisfied developers; less stressed can increase productivity in organizations that develop software.

**Keywords:** Home-Office · Model · Software · Software projects · Software industry · Developers

## 1 Introduction

### 1.1 Context of Companies that Develop Software

In Mexico there are great cities such as: Mexico City, Guadalajara, Monterrey, Puebla, Querétaro, etc. in which Software Industry exists. Due to the size of the cities, there are mobility problems that cause software developers to invest a lot of time in the travel as

well as disbursing a significant part of their salary in transport. The Home-office modality tends to grow, however, there is no reference framework to make the most of this modality.

The home-office mode looks for scenarios in large cities such as Mexico City, which, according to Moovit, up to 30% of workers make a trip of more than two hours to go to and from work, in turn, they are required 88 min to move on a weekday. On the other hand, they need to travel up to 9.9 km on average and at least 28% travel more than 12 km [1]. Another study by Schafer and Victor found that a person spends 1.1 h per day per travel, so in a large city rapid transport systems are required [9], however the development of this type of transport is limited to resources and design of the cities, such is the case of Mexico City.

The home office is not only a space but a place adapted to work with all the physical and even virtual elements to maintain a working environment of the work team [2].

Other factors such as lighting are really important because they directly influence the productivity of the developer. Natural light is ideal to avoid eyestrain, when natural light is not possible, then intelligent lighting must exist [3]. However, workers can have the same behavior of energy use in their home as in the office [4], so the developer should have good habits in the use of energy to not affect their economy by implementing the model of Home-office.

The social and family aspect of the worker can be affected when the worker works in a virtual office or at home, as revealed by the IBM study comparing a traditional office, virtual office and a home office. It can influence aspects of: job performance, work motivation, job retention and career opportunity, success in workload, life and personal and family success. Perceptions, direct comparisons and multivariate analyzes suggest that the influence of the virtual office is mostly positive in aspects of work, but somewhat negative in aspects of personal/family life. The influence of the central office seems to be mostly positive and the influence of the traditional office mostly negative in aspects of work and personal/life [5].

The aspect of information security is undoubtedly to be taken into account, because developers, from the office at home, must comply with and implement measures that allow the security of the information they store and transmit to the contracted cloud, for the organization [6]. In this case, each home office must have the same level of security as the main office, as well as maintain communication channels that allow the exchange of information with other elements of the work team and encourage interaction [7].

The information of the projects must be in the cloud to achieve accessibility by the developers of their office, taking advantage of the benefits of storage in the cloud that is used from education [8], for companies, among other important uses.

The hours that you must work from the home office must be those corresponding to the traditional office, however, in Latin America too many hours are worked [10] so, the developer should only cover the hours determined in his contract so as not to affect the relationship with their families and with their health. Work long hours can affect the health of the worker according to Spurgeon, Harrington and Cooper in the European Union the worker can oppose to work more than 48 h a week, however, in other cases and places like Latin America the days may be longer 50 h a week. The above affects the worker in possible effects on health and performance. It is concluded that there is

currently enough evidence to raise concerns about the health risks and safety of long working hours. However, much more work is required to define the level and nature of these risks [11].

The purpose of this paper is to propose a Model that allows defining how to implement the Home-office mode in the large cities of Mexico. It is intended that the model contributes to the implementation of Home Office in the Software Industry. Researchers living in Mexico City and in the periphery were investigated, finding times of transfers and resources necessary for their mobility.

## 2 Materials and Methods

The model focuses on organizations that develop software projects through one or more work teams. The model combines Home Office (HO) with other environments: client-analyst, user-developer, trainer-developer, developer-developer, among others. Therefore, the model is considered mixed, on the one hand, tasks are carried out in the Project Office (PO) such as meetings to analyze strategies and agreements and on the other hand, work in HO by each developer. Without omitting that, they must be connected uninterruptedly by some means such as: mobile telephony, email, social networks, among other means. The previous Uninterrupted Communication Media (UCM) must be duly established in each organization.

The Project Activities (PA) will be carried out in the APO and in the AHO of the developers, so, there must be a strategy of integration of tasks in a server, but much better in the cloud. Therefore, it can be determined that the PA results from the sum of the activities carried out in the APO and the AHOs. See formula 1.

$$PA = (APO_1 + APO_2 + APO_3, \dots APO_n) + (AHO_1 + AHO_2 + AHO_3, \dots AHO_n) \quad (1)$$

Where PA are the activities of the project; APO are the activities carried out in the APOs; and AHO are the activities carried out in the AHOs of the developers.

### 2.1 Assignment of Tasks

The Assignment of Tasks (AT) will be carried out by the Project Manager (PM) in the APO or through the UCM. Each task must be defined and estimated in man-hours in order to establish the dates and times of delivery. Whereas each organization defines the hours to work per week.

It is recommended that the AT be weekly, preferably on Mondays in a meeting in the APO under a detailed work plan that defines tasks and times of completion. The above in order to know the dates and times of delivery of each task. Other tasks may be assigned at any day and time through an UCM. The Model that has been called HOMSI is proposed. See Fig. 1.

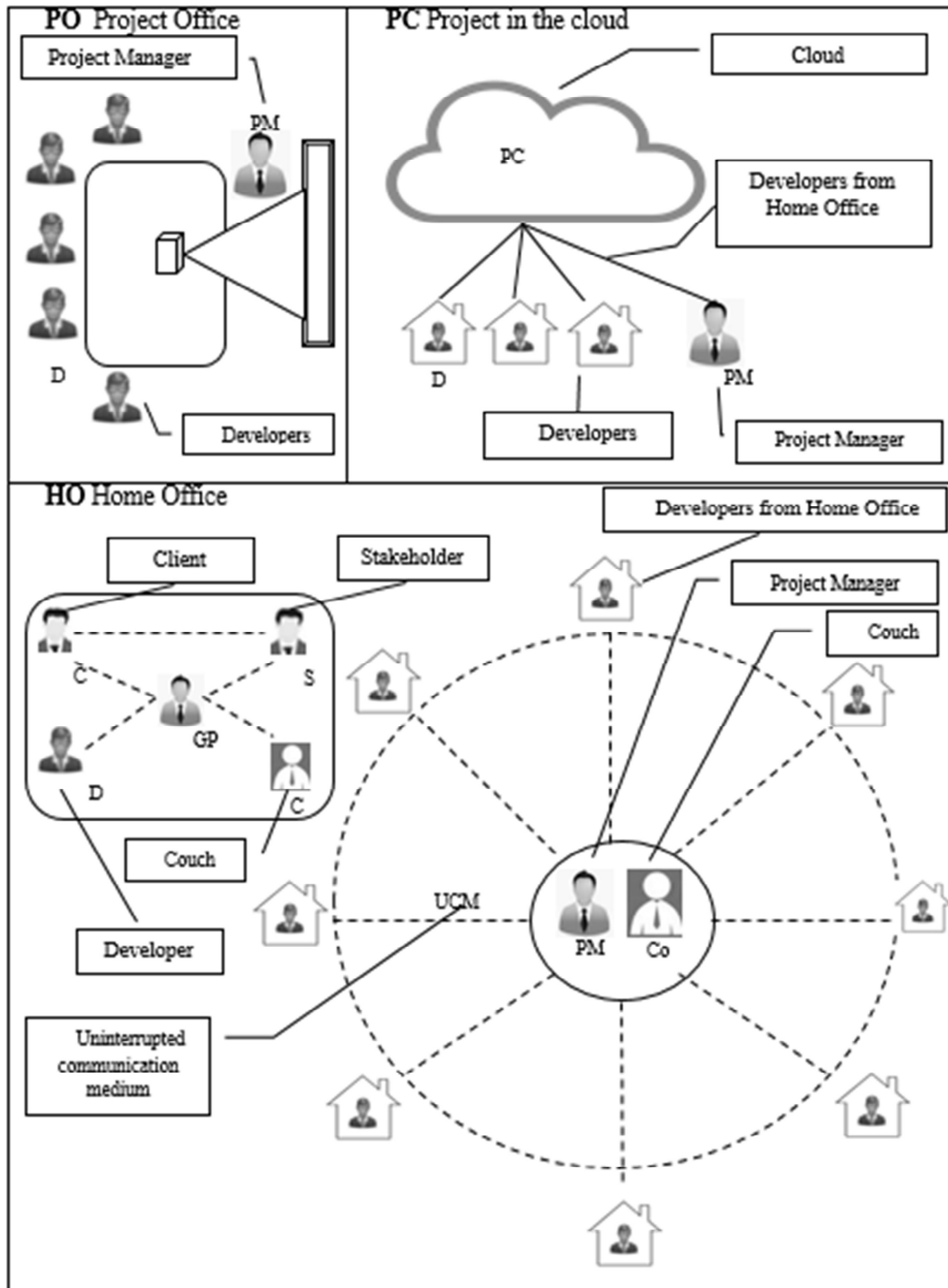


Fig. 1. Home office model for software industry (HOMSI) in Mexico.

## 2.2 Delivery of Deliverables

The deliverables are products of a task such as: text files, forms, designs, programming codes, reports, test results, etc. Once the developer finishes a task, he must send it on the date and before the established time through an UCM. The sending of new tasks to

the developer, as well as the delivery of deliverables by the developer, must be at previously agreed working hours, considering regional schedules if there are developers who live in different time zones. Therefore, each AT must have the following elements. Formula 2.

$$AT = (T, ETHT, D, Ti) \quad (2)$$

Where AT is the assignment of tasks, T is the task assigned to the developer, ETHT is the Estimated Time in Hours of the Task for the completion, D is the date and Ti is the time of sending.

There should be rules or policies to establish situations in which a developer will not work or send a deliverable out of time. For example, to notify at least 2 days before, the previous thing so that the PM carries out a new AT or adjustment to the plan of the Project.

### 2.3 Communication with the Work Team and Coach

The developers will be working from their HO, however they must be “connected” with the PM and the Couch at all times (it is recommended that the organization have it). In the same way, they can be connected with one or several fellow developers. The communication is a priority for some clarification or doubt and also for questions of socialization.

### 2.4 Home Office

The HO must have minimum conditions for the developer. The parameters are 6 to 9 m<sup>2</sup> independent of the rest of the house, with a door and a window for natural light and ventilation. With natural or adequate lighting, climate and noise under control. Table 1 details the characteristics of the HO space.

**Table 1.** Ideal characteristics of space of the HO.

Element	Characteristics
Space	6 to 9 m <sup>2</sup> Whit door and window Independent of the rest of the house
Illumination	Natural light or white light
Noise	It must be minimum or controllable
Temperature	From 19 to 26° centigrade
Colors	The colors of the walls should be clear avoiding: blue, orange, red and black
Furniture	A desk or work table of at least 120 by 180 cm A semi-executive or executive chair with backrest, height adjustment and wheels
Equipment	A desktop or laptop computer with at least 24-in. screen Printer, scanner, stapler, clips, white sheets, folders, pens, pencils, among other stationery items
Internet	It must have Internet connection preferably broadband

The work schedules should be the same as the PO to maintain communication under the same hours. The developer should not work more hours than his normal shift that must correspond to the schedule established by the organization, to avoid fatigue and exhaustion. Also, avoid eating at the HO at any time, but establish a meal schedule as if you were in the PO.

Hours worked (HW) in the HO must be accumulated during the week until completing a schedule established by the organization. In this case the weekly hours WH must coincide with the Estimated Hours of the Tasks Assigned EHTA. See formula 3.

$$WH = EHTA_1 + EHTA_2 + \dots EHTA_n \quad (3)$$

## 2.5 Expenses of the Project Office

The Expenses of the Project Office (EPO) will decrease due to the fact that there is not a paid work space for the development of the project. The costs of electricity, rent, security and hygiene will be paid respectively by the developers. However, who should pay the Expenses of the Home Office (EHO)? The company cannot pay for them, because they would have to generate individualized invoices for each developer, in addition to that, the expenses would rise, because they would be maintaining multiple offices instead of just one.

The model recommends an office with reception, a private cubicle and a meeting room. Whereas, the office can be shared or rented for hours or days. For example, on Monday mornings.

The expenses of the EPO home office are determined considering the elements of formula 4.

$$EPO = R + E + W + I + SH \quad (4)$$

Where EPO is the expenses of the project office, R is the rent, E is electricity, W is the water, I is the internet service and SH is the safety and hygiene.

The other option only corresponds to a rent of one day or n hours of a shared office. In this case the only expense is the rent payment that already includes the services.

## 2.6 Expenses of the Home Office

The Expenses of the Home Office EHO are generated by the consumption of electricity, water and internet, as well as safety and hygiene. In this case, the developer will pay for it along with the expenses of his house. So who should pay the EHO? In the model, it is proposed that the company grant a bonus to the developer to offset said payments. Formula 5 shows the origin of EHO.

$$EHO = P \times (E + I + W + SH) \quad (5)$$

Where EHO is the expenses of the home office, P is the percentage corresponding to the expenses of the office space, E is electricity, I is the internet service, W is the water service and SH is the security and hygiene

## 2.7 Travel Times

The Travel Time of the Developers (TTD) involves the trip from your home to the office and vice versa, see formula 6.

$$TTD = THO + TOH \quad (6)$$

Where TTD is the developer's Travel time in one day, THO is the time from your home to the office and TOH is the Travel time from the office to your home. In this case, not all developers take the same because it depends on where they live. So, formula 7 shows us the time of the entire team.

$$TTWT = TTD_1 + TTD_2 + TTD_3 \dots TTD_n \quad (7)$$

Where TTWT is the Time of Travel of the Work Team and TTD is the time of travel of each member of the work team. Therefore, TTWT is obtained from the time of each one of the members of the work team. Finally, it is necessary to calculate the type of travel during the project. Whereas, a project lasts n effective days, it is possible to calculate the total time with formula 8.

$$TTT = TTWT * NDDP \quad (8)$$

Where TTT is the Total Time of Travels of the entire work team during the duration of the project, TTWT is the Travel time of the work team and NDDP is the Number of Days of Duration of the Project.

The travel time does not directly impact the project, but should be considered, absences and delays due to problems during the travel, as well as stress and fatigue of the team members. In the case of a developer who lives two or more hours away from the office, he will have less time for rest and recreation.

## 2.8 Travel Expenses

Expenses for travels involve fuel, tolls and parking (if the developer uses a car) while those using public transport involve metro, bus or taxi payments. So, the daily expenditure of a developer is shown with the formula 9.

$$TED = TEHO + TEOH \quad (9)$$

Where TED is the Travel Expenses of a Developer, TEHO is the cost of moving the house to the office while TEOH is the cost of moving the office to the home. Whereas, you could take another route or type of public transportation. Therefore, there is a travel fee for the entire work team as shown with formula 10.

$$EWTT = TED_1 + TED_2 + TED_3 \dots TED_n \quad (10)$$

Where EWTT are the Expenses of Work Team Travels and TED is the travel cost of each developer considering that each has its own travel cost. Therefore, there is a total expenditure and travels reflected in formula 11.

$$TET = EWTT * NDDP \quad (11)$$

Where TET are the Total Expenses of Travels of the entire work team during the project. EWTT is the Expenses of Work Team Travels and NDDP is the Number of Days of Duration of the Project.

Similarly, the travel costs do not directly impact the project, but the developers that part of their income is spent on the travel, demanding better compensation to the company. With this model could be reduced by up to 80% to avoid going to the office weekdays.

## 2.9 Knowledge Management

The best way to transfer knowledge is face-to-face thanks to the interaction in the workspace. In this proposed model, the transfer of knowledge can be affected because the interaction through the UCM has certain limitations. Therefore, it is recommended to encourage interaction in meetings and training.

It is also recommended to use communication systems that allow to connect several users simultaneously so that during the day they can communicate between colleagues.

## 2.10 Tools for HOMSI Communication

An UCM is required to allow the work team to communicate with each other through the internet network. As well as, the developers with the Project Manager and the Couch. In the same way, the Project Manager with the client and the stakeholders. For what is recommended there is an UCM that guarantees communication at all times. In the market there are tools for this purpose from e-mail exprofeso tools such as: Google Groups, Skype, Cloud computing, among others.

## 2.11 HOMSI in Mexico

For the purpose of testing the HOMSI model, we research with developers in the software industry of the Mexico City, we designed an instrument for get information about the developers which are in the software development. We got 84 answers of developers which traveled daily a big city. With questions about of travel expenses and travel times. We include a men and women of different ages. On big and small organizations. With the data we did analysis and we find results which are presented in the next section.



### 3 Results and Discussion

#### 3.1 Space of Home Office

The days that 84 developers worked from 4 to 6 days. Although, most work 5 days a 77% there is a percentage of 16% that works 6 days and also a 7% four days, as can be seen in Fig. 2.

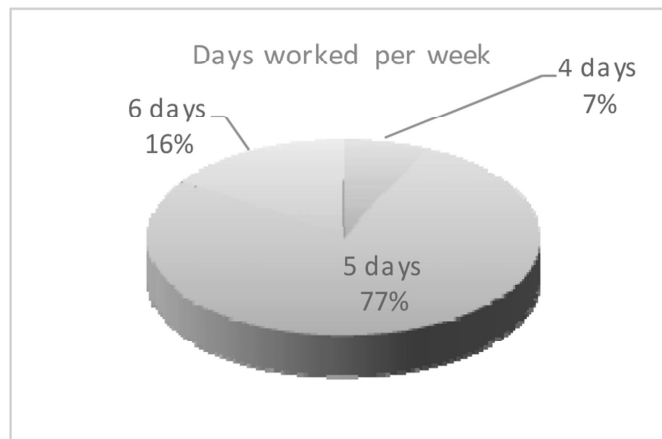


Fig. 2. Days worked per week in Mexico.

The time of travels from the developer’s house to the office goes from 0 to 15 min to 121 to 180 min. In this case, the largest number of developers requires 91 to 180 min, as shown in Fig. 3. The transfer time is very similar to round travel and return. The total time of transfer is the sum of go and return that can be from 30 min to 6 h.

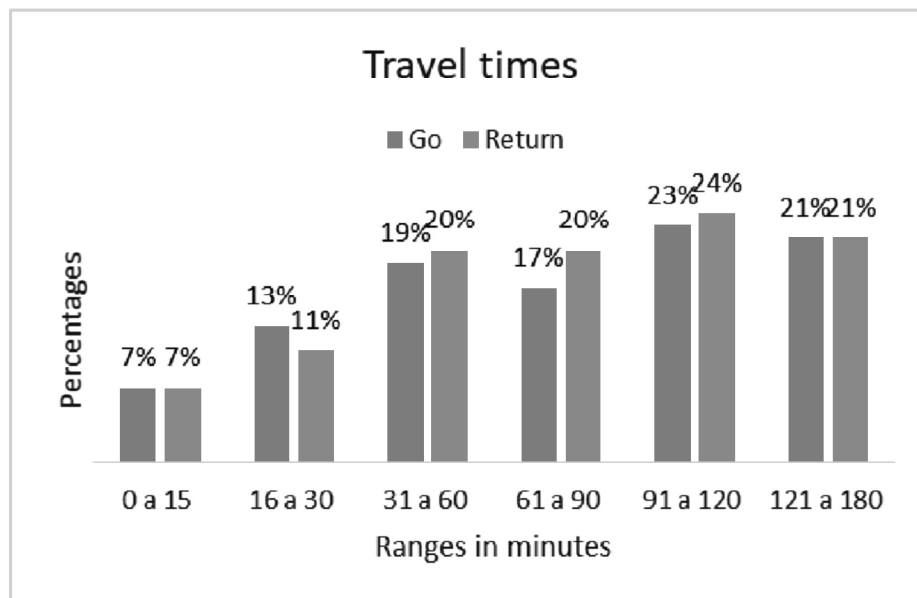
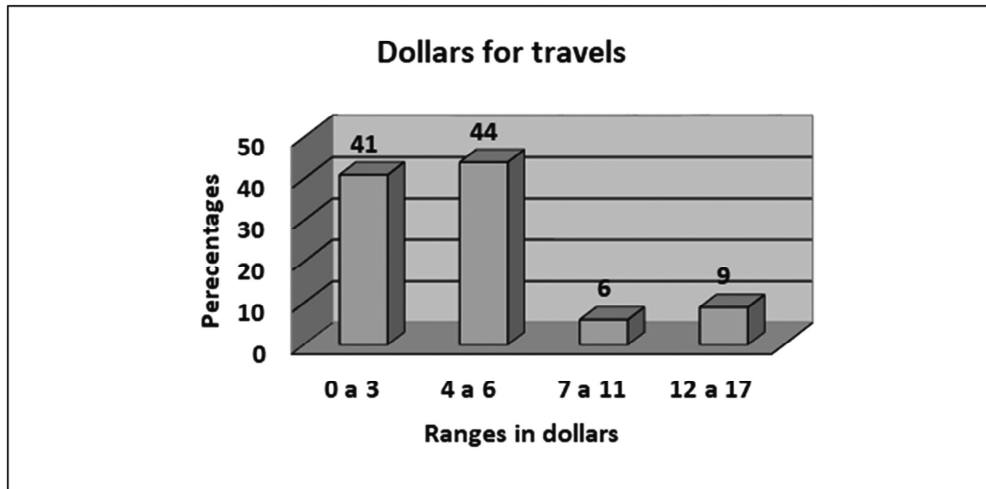


Fig. 3. Travels times for developers to and from work in Mexico.

Another important variable is the expense of travel from your home to the office and vice versa. In this case, the expenses converted to dollars as of April 18, 2018 are presented. Expenses can range from 0 to 3 dollars to 11 to 17 dollars. In this case, the travel expenses are concentrated in 6 dollars as can be seen in Fig. 4. In this case, the expenses are concentrated from 0 to 6 dollars.



**Fig. 4.** Cost in dollars of travels of the developers in Mexico City.

Of the developers surveyed only 38% have a space of 6 to 9 m<sup>2</sup> to adapt an office, however, 80% have internet at home. The above indicates that in Mexico we still do not have the optimal conditions for home-office.

The transfer of the developers affects them mainly in “Tiredness and exhaustion” to 54%. So, it can affect the developer in the daily activities.

## 4 Conclusions

There are traditional offices, virtual and Home-office. Traditional offices are decreasing, while virtual offices and Home Office are on the rise. Home-office mode is a trend in our days, because organizations seek to minimize their office costs. On the other hand, the travels are getting slower and longer. The proposed model HOMSI defines a framework under which organizations that develop software can work. It was found that, travels range from half an hour to 3 h. On the other hand, expenses range from 3 to 6 dollars per day. Therefore, implementing HOMSI can save time and money, in addition to reducing stress on developers. It is important that the home office should have good lighting, low noise, privacy, Internet connection, security in the internet network, among other factors. It is expected that, in the future, more organizations will implement Home-office, improving their productivity and employee satisfaction.

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