

A Comparative Machine Learning Study on IT Sector Edge Nearer to Working From Home (WFH) Contract Category for Improving Productivity

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Abstract: Many private companies in India offered working from home (WFH) for employees due to COVID'19 lockdown. The WFH has both merits and demerits for the employees as well as employer when it compared within office working environment. Many research works is showing many opinions about increases or decreases of productivity in the real time for any industries. This works talks about WFH impression is leads to edge nearer for the efficient productivity to any employer. In addition, the research article is providing survey of the benefits and demerits of WFH in India. In the view of the higher capacity, ultra very low level inactivity for better security is in the internet domain, there are lots of benefits in telework, and internet based work. The predicting development is done by Random Forest, Decision Tree, and Naïve Bayes for future with the help of three datasets. The datasets has taken from three types of general public such as city, town, and village for this research analysis. This research article is weighing up the rate of changes of productivity from the employees. Finally, this research work compares the learning method analysis includes prediction of rate of change of productivity from employees at city region. This prediction is computed by ML algorithm. Based on this prediction employers can improve and plan for their production and control the system in a better way.

Keywords: *Machine learning prediction*

1. INTRODUCTION

In order to get for reduction of office rent costs, balancing life style and saving travel time, WFH is alternative choices given by employer to employees based on positive factor. Many countries are preferred WFH strategies for employee in order to avoid the pandemic during COVID'19. Therefore, WFH has become best alternative choice to improve productivity in an IT sector [1]. Because of the productivity is the most important factor in business sector for any type of industries. Also, productivity is the key influencing factor in any growth of company. The positive and negative factors are playing important role in rate of change of productivity of an industry. The clean environment (no pollution, better air quality, no traffic) is shown in figure 1.



Figure 1 Pollution free in Indian road during COVID'19 lockdown

The purpose of this research article is that provides broad idea about WFH practices and changes in productivity of employees as well as employer with different parameters. Mainly the target sector is IT, manufacturing, agriculture units who offer WFH for employees [2]. Also, this research article gives study on WFH impacts on employee's productivity which is published recently. The snapshot of road accident scenario in India's road shows in the figure 2.



Figure 2 Road accidents scenario

Based on above said factors, the author wants to conclude that lot of benefits and demerits of WFH are tabulated in table 1 as follows;

Table 1 Benefits and demerits of WFH

BENEFITS	DEMERITS
Reduction of air pollution	Lack of good working environment and office equipment
Spend time with family	Children and family demand more attention
Improvement in health issues	Difficulties of concentration in continues work
Reduction of road accident and death	Fails to access old documents
Increase productivity from employee	High risk for productivity
Reduction of maintenance cost for Employers	Low reliability and retention
Go green environment due to less traffic	Resource stocks will fall down in any country

2. ORGANIZATION OF THE RESEARCH

This research article covers introduction, literature survey, with research gap, real time practical survey approach and discussion for predicting productivity changes in any industries, Results and discussion in a row. Finally, conclusion with future improvement is discussed.

3. RELATED WORKS

L. Chang & W. Chen conduct test in data mining research focusing on decision tree based model for measures road accident frequency by data set. Also, they were constructed the hybrid model to predict the traffic accident in highway with the help of traffic analysis and minimum environmental factors [3].

The India is one of the most air polluted countries in around the world. The survey is saying the population growth is 25% between the year of 2001 and 2011 in India. Most of the city's populations are almost exceeding more than 10 million recently [4]. This causes polluted of air & water in the city. Many of the relaxation such as subsidies for many polluting sources were removed by government. Initially they have planned to reduce air pollution by closing old, pollution making industries, reduction of traffic related pollution. But during COVID'19, air was not polluted due to "No" traffic, vehicle and closure of many industries.

Thiago Herick de Sa et al and Sá TH et al concludes their results that moving to ancient transport such as cycling, walking provides healthier life and air as well as reduction of road accidents and damages as like shown in figure 2 [5, 6]. Nilay Nishant et al discusses about the lockdown implementation in whole various India's states. They extended their work to calculate vulnerability index for corona infected people. They have used for this Ordinary Differential Equation (ODE) [2, 7].

L. J. Muhammad et al discusses about road accident with historical data and provide decision tree and future prediction for road accident, location and time scenery [8]. Osmar Pinto Neto et al introduce some mathematical modeling to predict the future forecast to behavior of COVID'19. And they obtained a result those prediction errors for the number of deaths [9].

Zizhen Zhang et al presented sobol's method which is nothing but global sensitivity analysis method is used to analyze the effects of COVID'19 and find the key parameters for controlling parameters and work out. They have done mathematical modeling for the analysis sensitivity [10].

Schraufnagel DE et al discusses about health benefits while reduction of air pollution and climate change in any country. In addition to that, they discuss about use of face mask in future, breathing characteristics analysis and technical challenging task to assessment for inhaled air pollutants. They focus on closure of many air polluted factory; gives better air qualities benefits [11]. One of the famous private company Tata Consultancy Service (TCS) chief executive has answered about WFH is that "we are not going to back to where we were," currently. Many of managers from private company are saying that in order to make a new model a success is facilitating the work from remotely [12]. Many of the authors are discussed about improvement of air quality provides healthier life and reduced traffic accident and so on. Here, we get an idea to propose the WFH gave no traffic and pollution during the time of COVID'19 [13]. From these demands, we developed a mathematical model for future prediction of many industries' working style with the help of various research factors.

Research Gap

The author novelties the research gap in this COVID'19 situation. Some of following research questions is answered in systematic way in this research article. The various learning technique is predicting forecast for future scope of WFH and predicting rate of change of productivity for any industries.

Research Questions

This research article provides answer for following inquiries questions.

1. Will WFH provide better productivity from the employees?
2. Positive factors for WFH from both employee and employer side.
3. Negative factors for WFH from both employee and employer side.
4. Any changes in the productivity in private IT sectors after year 2019?

4. THEORETICAL APPROACH AND DISCUSSIONS

Production rate prediction for any industries before, during, after COVID'19 by machine learning algorithm discusses in this section.

4.1 Positive factors

(a) Virtual connection

The virtual connection between the colleagues will give new experience and knowledge of internet. No need of pay for the office space and equipment but all will be connected together with our daily usage equipment for example

mobile data communication. Also, there are no more time waste and useless meetings which means that not relevant meeting for every individual.

(b) Resource Consumption

First of all, the travel expenses will be reduced a lot. Based on this stroke, there are more benefits as follows,

1. Reduction of conveyance fee and office maintenance charges for employers
2. Make a green environment due to no travel expenses between home to office as shown in figure 1.

(c) Improve the Immune system

The employee will be happy due to reduction of many expenses as well as he will be very fit in physically. So he can deliver more energized work in his job and accomplish with good accuracy. Also there is a less chance to spread infection; family is safe. Due to reduce travel time between home to office, he will get more time to spend with his families. Automatically the immune system in the body will be increased the reason of home food too. So the employee avails less sickness leave for any medical reason. Due to improving immune system, the efficient employee can maintain the life balance for better work style and environment.

4.2 Negative factors

(a) Siloed from each other

Initially the WFH can make life is easier but after some time it turns to damage the employee's mental health. There will be a creation of frustration because of humans are social concern category. The relationship with co-workers will be diminishing for a long time WFH [14].

(b) Potential Burnout

There should be distinction between work and family (home) life in any human life. This dilemma status can be created mental stress and which leads to reduction in productivity. The co-worker will expect encourage words after finish their small achievements. Therefore totally the potential of employee will be diminishing gradually. The webinar orientation cannot give full-fledged output like as real-time practical workshop to the worker community. The development of staff will be a problem because of no new learning through real-time practical experience.

(c) Difficulty in Monitoring

Definitely, the monitoring of employee is challenging task while they are from home. The more home distraction presents for WFH employees [15]. So the different personalities may cause health issues after long time survival from home.

4.3 Changes in rate of productivity from employees

4.3.1 Before COVID'19

Before COVID'19, the production rate is sinusoidal and it is hard to estimate past many months. Our survey comprises about various sector industries productivity rate and prediction model.

4.3.2 During COVID'19

Some 40% employees are working remotely and they are still working and have transformed the workplace experience. Many authorized and labeled forum indicates that due to 35% of employee the few months in starting of pandemic, there productivity rate is increased. The co-operative task industries are showed minimum productivity improvement rate only. It is because of that this includes "exchange of co-workers", "working as a team", and "executing administrative tasks" like a physical presence of receptionist work in any industries.

4.3.3 Observation for Prediction after COVID'19

From these period changes parameter are consider for future prediction to IT, Manufacturing, Agriculture sectors. In this research paper, combined our work that some factors are driving worker productivity and company's success depends on their individual skills. Based on these many parameters, the following mathematical model is deriving for future prediction for changes in rate of productivity of various sector industries [1, 16]. The

mathematical model can be derived from above said factors for the future prediction [17]. The past-present observation is denoted as $x_{pp}(t)$. The consideration of immune system factor with respect to time is denoted as $IS(t)$.

$$\frac{dx_{pp}(t)}{dt} = \frac{[1 - IS(t)]\beta \cdot x_{pp}(t) \cdot \gamma}{N_{ds1,2,3}} - \alpha(t) \cdot \beta(t)$$

$$\frac{dp_d}{dt} = \alpha(t) \cdot \beta(t)$$

The notation β & γ is indicated for negative influencing factor and positive influencing factor respectively. The production rate can be taken as $\alpha(t)$. The production decrement also is noted as p_d .

$$\alpha(t) = \alpha_0 \frac{\log(t + 1)}{\log(t_p)}$$

Also α_0 is considering for initial production rate. The expecting prediction for forecast is $E(t)$. The positive symbol also indicates future prediction for rate of change of productivity.

$$IS(t) = IS_0 \frac{1}{1 + e^{-(t-t_{IS})}}$$

$$\frac{dE(t)}{dt_p} = + \frac{[1 - IS(t)] \cdot \beta \cdot x(t) \cdot \alpha}{N_{ds1,2,3}} - \gamma \cdot E(t)$$

4.4 Proposed Architecture

Based on above said factors, the author constructed proposed framework. The work flow and proposed architecture block diagram shows in figure 3. The collected data is preprocessing for removing unwanted and more noisy data. The splitting the data for training and testing is to improve the speed of the overall execution time of processing. The training data is comparing with ground truth label to ensure the original of trained data. The data classification section is training the parameter and predicting future forecast with the help of different algorithm.

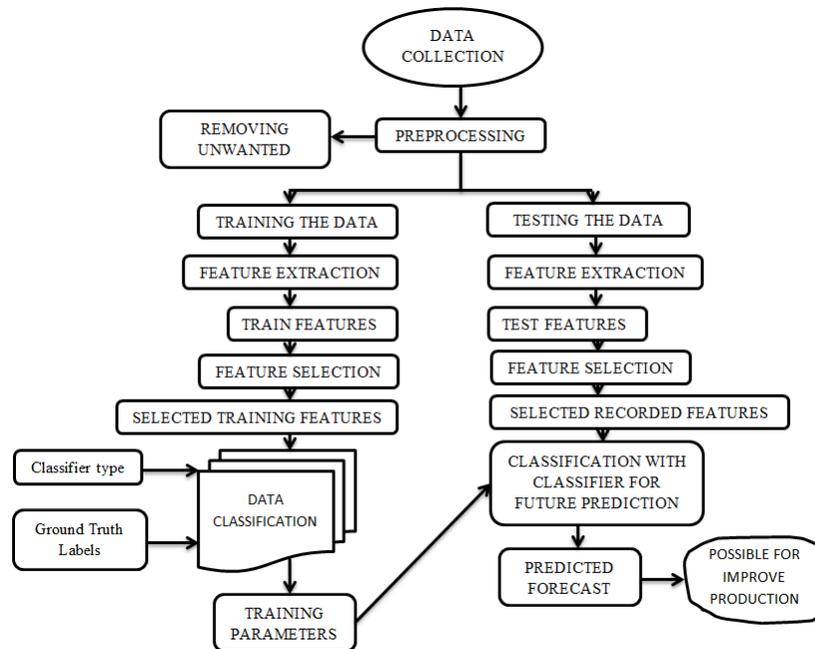


Figure 3 Our proposed prediction architecture model

This may go for possible of improving the production in any industries [18]. This task is for future enhancement of our research work. Finally we concluding that the information technology sector can prefer and give a try WFH with some percentages of key employees of them. Based on the trial version, the individual employer can decide either goes for WFH with fully functioned or not.

5. RESULT DISCUSSIONS

The figure 4 shows the WFH can be influencing by various negative and positive factors in different public domain such as city, town, and village. Generally, the city public domain has more impact 82% on WFH by positive approach and very less 18% by negative factors. The town domain is having moderate impact on both. Also the village domain is almost 10% impact only by positive factors.

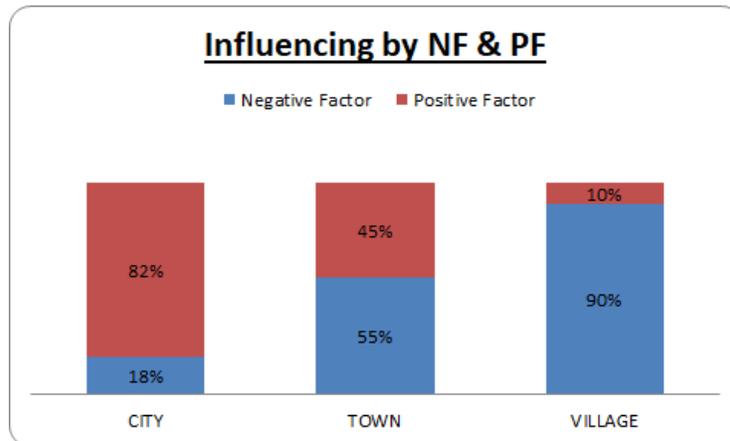


Figure 4 NF & PF influencing in different domain

These graphs in figure 5 shows the productivity improvement analysis of IT, Manufacturing and agriculture sectors with the help of dataset 1-3. These datasets are collected for compute rate of change of productivity improvement on before and during COVID'19.

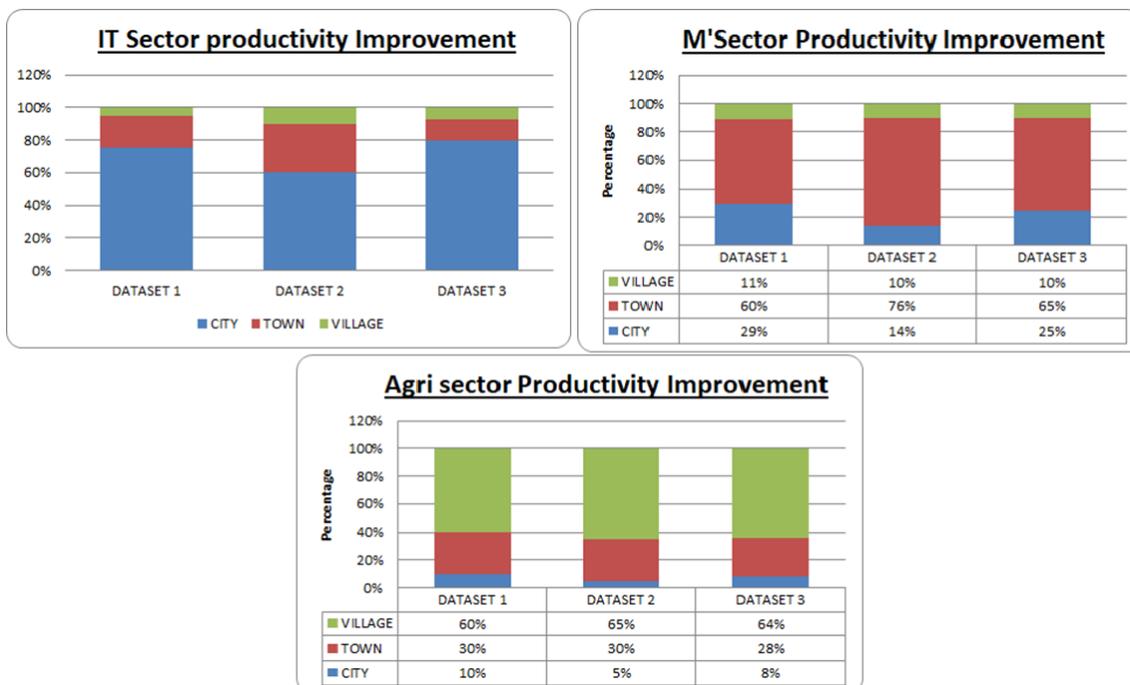


Figure 5 Productivity improvements before and during COVID'19

The figure 6 shows the various algorithm of ML prediction in different sectors. In the IT sector, there is a definitely around 70% change in rate of productivity with the help of prediction ML algorithms named Random Forest, Decision Tree, and Naïve Bayes. The remaining manufacturing, agriculture sectors are having less percentages around 25% to change in rate of productivity.

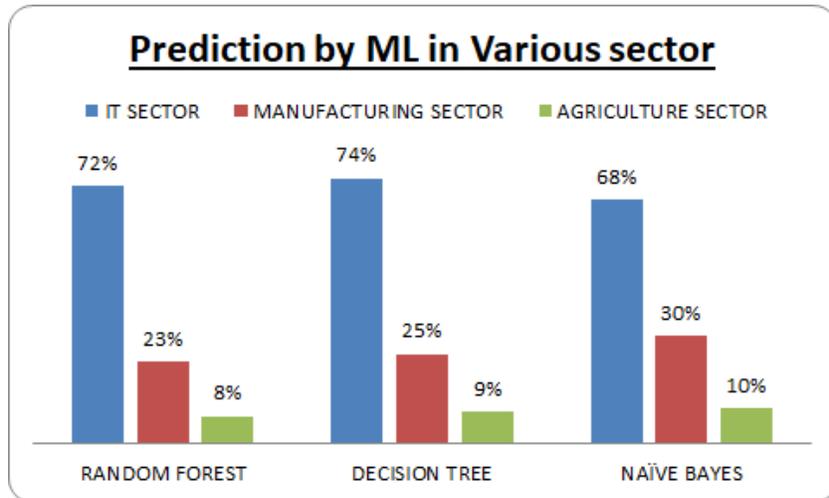


Figure 6 Machine learning prediction in various sectors

The figure 7 shows the overall improvement in rate of change of productivity after COVID'19 by various algorithms. Approximately all the forecasting algorithm shows in this graph is that incremental scenario in the rate of change of productivity at public city domain. The prediction rate is slower by random forest algorithm which is showing almost straight line in the graph. And other two algorithms are having little bit faster changes in rate of change of productivity shows in figure 7. By the way all algorithms are concluding that there is an improvement in rate of change of productivity at city domain even though they offer WFH.

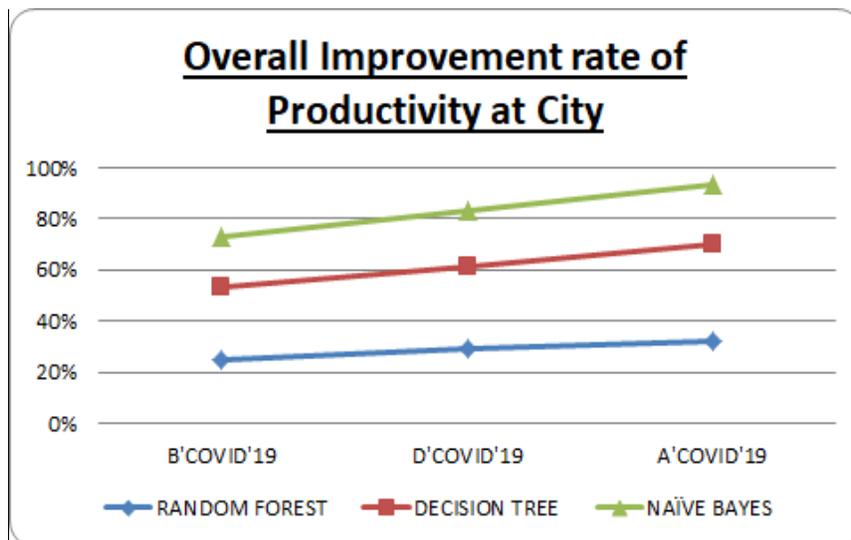


Figure 7 overall improvements in change of rate of Productivity

6. CONCLUSION

The engaging from home is providing effectiveness for information technology sector companies comprises of an information analytics, individual action process, remote document reviewing. But the efficient will be very low in the manufacturing industries, commodities, reviewing agriculture sector, hospitalities in various sectors. As companies gets familiar the thought of functioning from home that they are going to become hospitable victimization. WFH may in addition facilitate embody extra women into workforce that engaging the work in home. The graph in figure 7 is showing the growing rate of productivity and its predicting the future scope for WFH will grow. The huge rewards can be accomplished due to WFH with the efficient employees.

FUTURE ENHANCEMENT

In future development, the character and attitude of the employees in any type of industry will be added and classified. Therefore, we will get better accurate predicted output for future prediction about productivity of any industry. Also consideration of many researches inquires and factors will give good accuracy of predicting. The possible for improve productivity in any industry will be further challenging task and it is continuation of this research work.

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