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About the Journal

The Gavesana Journal of Management is a bi-annual refereed journal of the Vignana Jyothi Institute of Management. Its objective is to disseminate knowledge of contemporary issues related to management and development. The journal seeks to serve as a platform for intellectuals to share the rapid strides made in contemporary research. The Research Journal has been registered with the Registrar of Newspapers for India (RNI) vide No. 108534/2010 dated 1/3/2011.

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EDITORIAL

Human Resource function (HR), in any organization, has to be that of a strategic or business partner, by developing the talent in the entity through job rotation, job enrichment etc., involving expert teams, business leaders and line management. Such a partnership is a long-term relationship to achieve objectives common to the partners, as also the organization's financial success. In the process, the HR employees, as partners, should perform their assigned roles, and also support the activities of those in other functional areas. This needs a strategic plan which dovetails the HR Vision and Mission into that of the organization.

HR, as a Strategic Partner - increases employee productivity and thus the organization's profitability; enhances competency and talent management; uses the technology and knowledge to formulate, implement and review strategies; copes with the changes in the business environment arising from unforeseen business situations, and globalization; and serves the internal and external customers well. This is done through efficient and effective delivery of human resource services. For this, the HR needs to spend more time in the organization's planning, design and development. It must become part of the business team, involved in planning at the highest level. HR Managers and HR professionals are strategically suited to provide the necessary leadership in change management, which is a challenging task.

The Human Resource Information System (HRIS) has to be effectively used to handle daily administrative HR tasks. Employees can make use of the self-service facility online, to support business strategy development and implementation, which saves time and costs. There should be an HR Head who understands well the strategic partnership/relationship between organizational strategy and human resources. He should be an expert in all HR functions. Someone from within the organization can be groomed for this role.

Research has shown that the HR function will be effective in achieving the business objectives when it assumes the role of a strategic business partner. The top management should ensure this. The administrative reactive approach in people management can no longer support the organization in a competitive business environment. If the HR function is decentralized fully, the line managers and supervisors will eventually put the blame on HR when problems arise. If this happens, it interferes with the effective use of line managers' and supervisors' time in the operations of the organization on daily basis. The line managers and supervisors need to be supported to make them more proficient in managing their subordinates in the performance of daily tasks. Complete participation of HR people in strategy development and implementation promotes HR as a strategic partner. The HR Manager and HR professionals should contribute to business decisions; develop business acumen to understand how a profitable business is run; be customer-centric; and learn how to link HR practices to the organizational business strategy.

The expectations from HR as Strategic Partner include: recruiting the right employees; align corporate values to the recruitment strategy; well-developed competencies of the workforce, and their relevance to organizational core business; participative culture where HR initiatives fully support the overall strategic plan; discard ineffective HR practices that do not contribute to the success of your organization. HR management requires continuous improvement i.e., Kaizen to ensure and retain its relevance as strategic partner. For this, capable and committed people are needed at every level, supported by senior management. Change has to be managed well to avoid or minimize disruption in the organization's activities, and for its success.

The effectiveness of the HR people as a strategic partner is also dependent upon the corporate policies and practices, structure, types of activities carried out, location, effective communication, leadership and motivating employees to keep moving in the right direction as per plan. Every aspect of HR has to be reviewed in the process of implementing the necessary changes and reorganization. Having the right is crucial to help them succeed and engage their full attention with the view to ensure HR truly becomes strategic partner. The HR Scorecard shows whether the organization is making good progress on making HR as strategic partner. The competitive advantage of the organization can be enhanced by aligning the HR strategies to the overall business plan. To ensure that HR truly becomes a strategic business partner, adequate financial backing is necessary. One needs to take measures to eliminate or minimize risks to HR, and it should be ensured that HR plays a meaningful role and not necessarily a major role, particularly during financial crises. It cannot also be a trial and error approach.

In fact, in a business landscape that is changing fast, there is an imminent need for HR to be an active strategic partner. By aligning itself with strategic plans of the business, it needs to foster a stronger relation between the executive team and the workforce. Externally, it can make valuable contribution to branding and the tone of communication. By leveraging customised, more personalised metrics and deep analytics, it can vastly improve organizational learning, training and improve decision-making. Consequently, the human capital program will lend more impact, thereby encouraging and enhancing collaboration between various functions across the organization. HR can no longer be just a functional arm, a distant participant, but will have to assume the role of strategic partner, integral to organizational well-being and growth.

Dr. Ch. S. Durga Prasad

Productivity Growth Assessment of Primary Agricultural Credit Societies in West Bengal

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Abstract

The importance of primary agricultural credit societies (PACS) in the cooperative structure in India is apparent. The present study makes an analysis of total factor productivity growth of PACS working under their respective District Cooperative banks (DCBs) in thirteen districts in West Bengal during 2010-17. The productivity growth assessment is made with the help of efficiency change due to technical and technological factors and based on Malmquist index. With regard to the first measure, only four districts show that there is positive impact of efficiency change. However, the impact is minimal in most of the cases except Burdwan. With regard to the effect of technological change, it is observed that except for Dakshin Dinajpur and Jalpaiguri, the effect is positive. In fact, the districts that show a higher positive effect of technological progress include Burdwan (6.4%), Raiganj (2.7%) and Howrah (2.2%). The result of Malmquist index shows that ten districts show a progress with Burdwan dominating with a growth of 34.5%. For the remaining others, the growth is not significantly high..

Introduction

The history of co-operative movement in India is more than a century old. The Indian cooperative sector completed 115 years of its existence in 2019. The movement started in India with a view to encourage and promote thrift and mutual help for the development of persons of small means such as agriculturists, artisans and other segments of the society. It was also aimed at concentrating the efforts in releasing the exploited classes out of the clutches of the money lenders. Keeping this as one of the objectives, credit societies were formed under the Co-operative Societies Act of 1904. The Act was largely based on the English Friendly Societies Act, 1896. Under this Act, only primary credit societies were permitted to register and non-credit and federal organisations of primary co-operative credit societies were left out. This lacuna was bridged by the Co-operative Societies Act, 1912 which paved the way for the organisation of central co-operative banks throughout the country. But the provisions of this Act were inadequate to meet the requirements of those states where co-operative movement had made considerable progress. Bombay (presently Mumbai), the pioneers in this regard passed a new Act, viz., the Bombay Co-operative Societies Act, 1925 for serving the many sided development of the state. Later on, Madras (presently Chennai), Bihar and Bengal passed their own Acts in 1932, 1935 and 1940 respectively. The Multi-Unit Cooperative Societies Act was passed in 1942, which delegated the power of the Central Registrar of Cooperatives to the State Registrars for all practical purposes.

The state patronage to the cooperative movement continued even after 1947. Independent India accepted the concept of planned economy and cooperative organizations were assigned an important role. In the post-Independence era, different committees were formed and important Acts were also passed some of which include the NABARD Act, 1981, Multi-State Cooperative Societies Act, 1984 (modified in 2002), Model Cooperatives Act, 1990 and National Cooperative Policy (2002) for the development of the cooperative sector.

1.1 Structure of Cooperatives in India

The Short term Co-operative Credit Structure (STCCS) in India is pyramidal in nature. It has a three-tier structure: (i) Primary Agricultural Credit Societies (PACS) at the bottom, (ii) Central Co-operative Bank (CCB) at the middle and (iii) State Co-operative Bank (StCB) at the top. The primary societies function in various towns and villages, the Central Banks at the district headquarters and the State Cooperative Banks at the state capitals forming the apex of the system. The Reserve Bank of India assists the co-operative structure by providing concessional finance through

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NABARD in the form of General Lines of Credit for lending to agricultural activities. Thus, the whole system is integrated with the banking structure of the country. The STCCS functions as a three-tier structure in 16 states; while in 13 smaller states & union territories, PACS are directly affiliated to the StCB and the STCCS functions as a two tier structure. In three states, a mixed structure, i.e. two tiers in some districts, and three-tier in the other districts is in operation.

1.2 Concept and Role of PACS

In principle, PACS are expected to mobilize deposits from its members, and use the same for providing crop loans to the needy members. However, as deposits in PACS are not enough to meet the loan requirements of its entire farmer borrowing members, they draw support from the federal structure, viz., the CCB/StCB. The CCBs were therefore, constituted as a small bank working in small towns to mobilize deposits from public and provide the same for supporting the credit needs of PACS and its members. As part of the federal structure, the CCBs were also expected to provide guidance and handholding support to these institutions. StCBs were set up in each state not only to mobilize deposits but also to provide liquidity support for agricultural activities. Moreover, whenever required, the StCBs were also expected to mobilize liquidity and refinance support from the higher financing institutions like NABARD for supporting the crop loan operations of CCBs and PACS affiliated to it. Over time, STCCS has also been providing medium-term loans for investments in agriculture and for the rural sector, often with refinance support of NABARD. PACS, being financial intermediaries, render financial services with the objectives of growth, profit and services. These intermediaries which conduct their business mainly using borrowed funds play a crucial role in improving the economic and social condition of the common masses and provide short-term and medium-term loans to the members/farmers at reasonable interest rate to meet their needs. They provide credit to the farmers for agriculture purposes at cheap and easy terms. PACS, therefore, form the foundation of the Cooperative Credit System on which the super structure of the short term cooperative credit system is built.

The banking scenario is changing constantly and significantly due to rapid and radical reforms taking place in the industry. With the pace of the changing banking scenario, the co-operative credit system is also affected. The present study reviews the situation by looking at the performance aspect of PACS from the angle of total factor productivity growth.

2. Review of Literature

There have been several studies and research work done on the co-operative banking sector of our country. Here is the summary of a few articles on the performance of short term co-operative credit structure as well as the performance of PACS in the Indian context which are cited below.

Bhaskaran and Josh (2000) conclude that the recovery performance of co-operative credit institutions continues to be unsatisfactory which contributed to the growth of non-performing assets even after the introduction of prudential regulations. Jain (2001) in the comparative study on District Central Cooperative Banks (DCCBs) of Maharashtra, Gujarat and Rajasthan found that the institutions of Rajasthan perform better in terms of profitability and liquidity. Kulandaiswamy and Murugesan (2004) study thirty PACS using thirteen performance parameters in the selected development blocks of western Tamil Nadu using field survey data. They identify working capital, total loans outstanding, total business turnover, overdues, net worth and loans to weaker sections as the key performance indicators. Cahalam and Prasad (2007) in their empirical study looked at the liquidity, operational, productivity and profitability ratios to study the financial performance of nine select PACS in Andhra Pradesh. Shah (2007) makes an attempt to measure the viability of PACS during the pre- and post- economic reforms period. Basak (2009) examines the case of Contai Co-operative Bank Ltd. West Bengal to identify and analyze their trend, progress and problems. The study for 1995-96 to 2006-07 uses statistical tools for analysis. Misra (2009) identifies the factors that contribute to the unstable financial condition of PACS. The study finds that the government contribution to the share capital of the cooperatives adversely affects the recovery performance. It also finds that larger membership size has a negative effect on recovery performance which was the same as seen in the case of higher proportion of non-borrowing.

Chander and Chandel (2010) make a study on the financial viability, efficiency and performance of four DCCBs

operating in Gurgaon division in Haryana (India) for a period of twelve years from 1997-98 to 2008-09 by financial analysis and z-score analysis. They conclude that though DCCBs play a pivotal role in the rural banking and the failure/bankruptcy of these banks raise doubts about their viability and sustenance. Jadhav (2010) in the study on co-operative banks identifies lack of awareness among the customers about their rights to various banking facilities, lack of knowledge and skills of the employees of the banks and also comments that resistance against change in the system by all levels of the employees and management including top executives of the banks is posing problem for the cooperative banks. Rachana (2011) makes a detailed study on financial inclusion and performance of Rural Co-operative in Gujarat. The researcher comments that since Regional Rural Banks (RRBs) and PACS run into losses despite having wide coverage, commercial banks should seize this opportunity rather than looking at it as a social obligation. Agrawal and Solanke (2012) make a study on cooperative banks to find out the problems in Indian perspective. Babu and Selkhar (2012) in their study on the performance of urban cooperative banks (UCBs) find that though it is quite satisfactory, there is a reduction in their number since 2004. Bansal and Thakkar (2012) point to the problems like undue government interference, poor governance, high overdues and lack of deposits, financial indiscipline and accumulating non-performing assets. Bhatt (2013) determines the efficiency of cooperative banks operating in Jammu and Kashmir by looking at their technical efficiency. Das (2013) evaluates the performance of the West Bengal State Cooperative Bank Ltd. for 2001 to 2010.

Soni and Saluja (2013) in their study on Cooperative societies of Chhattisgarh for 2009-12 attempt to analyze the role of co-operative banks in agricultural credit. Thirupathi (2013) makes a thorough analysis of financial performance of select PACS in Tamil Nadu. The study recommends the need for improvement of owned funds, deposit mobilization, deployment of funds and diversification of lending, management information system and marketing arrangements. Avhad and Chintamani (2014) analyze the performance of DCCBs by looking at their membership, number of offices, capital, deposits, advances, reserves and overdues for the period 2002-03 to 2011-12. Attri and Paul (2015) make a study on state co-operative banking in India. The paper focuses on branch networking, capital, advances, deposits, working capital and recovery performance of these banks in India. The research reveals that the overall performance shows that the banks are working efficiently, increasing profits and using the managerial talent judiciously. However, the study brings to light that till 2007-08, the bank's liquidity position was not safe as it concentrated on credit dispensation rather than on deposit mobilization. Chandrashekar (2015) looks into the growth and structure of cooperative credit societies in India and also studies the financial health and overall performance of UCBs in the country. Majumdar et al. (2015) conduct a critical assessment of select two PACS by looking at their financial position and also their role in promoting the agri-business of farmers and self-help groups.

From the above cited review of literatures, it is evident that there are a substantially good number of studies on cooperative banking in India. Some research gaps are identified as follows:

(I) Only a handful of researches have been done on the financial performance of PACS operating during the pre- and post- economic reforms period in India.

(ii) The review of literature reveals that no research has been conducted on the assessment of financial performance of PACS in West Bengal.

(iii) Further, the researchers have not come across any study that looked into the productivity aspect of PACS in West Bengal.

Hence the present research aims to fill the gap by looking at the productivity growth of PACS of selected districts in West Bengal.

3. Objectives Of The Study

(a) To identify the contribution of technical progress towards productivity growth.

(b) To assess at the contribution of technological progress towards productivity growth.

(c) To determine the total factor productivity growth.

4. Research Design

The components of the design for the present study are as follows:

Data type: The study is based on secondary data on PACS of thirteen selected DCBs of West Bengal (out of total 17 DCBs).

Data source: The secondary data is collected from the Annual reports released by the State Cooperative Bank of West Bengal at the Central Cooperative Banks' Conference in different years.

Data period: The period of the study is from 2010 to 2017.

Sample Design: The selection of the districts is on the basis of (i) descending order of deposit mobilized by PACS and (ii) availability of data for all years of study.

Research Methodology: The findings are based on the application of Malmquist Index which is used for determining factor productivity growth. For the purpose, the input used is deposits and the outputs are investments and loans. The output-oriented model is used under the variable returns to scale assumption as it is realistic in contrast to the constant returns to scale which assumes that outputs and inputs are going to change in the same proportion.

5. Findings And Analysis

The results of factor productivity growth focus on three dimensions which are (i) growth due to technical progress, (ii) growth due to technological progress and (iii) productivity growth. The first is referred to as the catching effect whereas the second is known as frontier effect. The former captures the progress due to technical efficiency which assesses whether the movement is towards the frontier (in case value is more than one) or away from it (if value is less than one). This component (called efficiency change) identifies how well the process of production transforms the inputs into outputs. The frontier effect, however, looks at the growth aspect resulting due to shift in the frontier (from improvement in production technologies) obtained for all the firms put together which is the outcome of technological advancement in the industry. The following paragraphs give the results.

5.1 Technical Efficiency Change

Table 1 gives the result of progress due to technical efficiency change. The overall position of PACS of different districts shows that there is progress in only three districts namely Burdwan, Mugberia and Murshidabad. There are four districts which show an overall decline which are Howrah, Malda, Purulia and Raiganj. The remaining six districts show stagnation in this regard with the geometric mean to be one during the period.

In the case of Burdwan, the overall growth of 26.4% is due to the abnormal growth in 2010-11 (415%). If we consider that to be an outlier and recompute the growth, it is found to be nil. Hence, the overall condition of PACS with regard to growth due to technical efficiency change is not so sound. It is expected that there is a need to grow by producing more outputs using the same/lesser amount of inputs. With respect to the trend in efficiency change, the mean score shows progress of 12.7% in 2010-11 to a regress of 5.6% in 2012-13 and 2.3% in 2016-17. The study period shows an overall progress of 1.2%.

Table 1: Technical Efficiency Change

District	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Geo. Mean
Bankura	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Burdwan	5.150	1.000	1.000	0.987	1.013	1.000	1.000	1.264
Dakshin Dinajpur	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Howrah	0.973	0.943	0.971	0.950	1.103	0.905	0.911	0.963
Jalpaiguri	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Malda	0.972	0.991	0.934	1.081	0.977	1.045	0.954	0.992
Mugberia	1.015	0.899	1.053	0.970	0.997	1.092	1.000	1.002
Murshidabad	1.078	0.992	1.071	1.000	0.997	0.960	1.044	1.020
Nadia	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Purulia	0.905	1.106	0.476	2.005	1.017	0.922	0.900	0.970
Raiganj	0.986	0.970	0.979	1.078	0.866	1.090	0.900	0.978
Tamluk-Ghatal	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
VCCB	1.000	1.000	0.991	0.986	1.024	1.000	1.000	1.000
Geometric Mean	1.127	0.991	0.944	1.059	0.998	1.000	0.977	1.012

Source: Calculated by the researchers

5.2 Technological Efficiency Change

Table 2 gives the result of the change arising from technological improvement during the period which is computed on the basis of year-on-year change. It is interesting to see that In this parameter the performance shows a considerable improvement in respect of growth. Of the sample districts, PACS of eleven show an improvement. Burdwan district that shows maximum growth in respect of the earlier measure enjoys the highest in this respect as well (6.4%) which is closely followed by Nadia (4.4%). However, the main reason for growth in Burdwan district is the jump in 2010-11. Excluding that year, the growth stands at a meager 1.99% which is quite low. The other districts show a growth rate that falls in the range of 0.2% to 2.7%..

Table 2: Technological Efficiency Change

District	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Geo. Mean
Bankura	1.000	1.000	1.023	1.000	1.026	1.000	1.072	1.017
Burdwan	1.376	1.000	0.975	1.039	1.061	1.006	1.041	1.064
Dakshin Dinajpur	1.000	1.000	1.000	0.971	1.022	0.962	1.000	0.993
Howrah	0.997	1.061	1.000	1.037	1.031	1.003	1.029	1.022
Jalpaiguri	1.000	0.996	1.000	1.000	0.925	1.000	1.000	0.988
Malda	0.999	1.002	1.026	0.988	1.028	0.976	1.059	1.011
Mugberia	1.000	1.057	1.009	1.014	0.997	1.028	0.996	1.014
Murshidabad	1.008	1.025	1.018	1.008	0.997	1.013	1.032	1.014
Nadia	1.043	1.088	1.058	1.000	1.034	1.021	1.067	1.044
Purulia	0.988	0.976	1.023	0.981	1.030	0.978	1.040	1.002
Raiganj	0.995	1.061	1.015	1.012	1.028	0.996	1.088	1.027
Tamluk-Ghatal	1.000	1.000	0.909	1.126	1.049	1.073	1.000	1.020
VCCB	0.996	1.076	0.999	1.003	1.040	1.000	1.017	1.019
Geometric Mean	1.027	1.026	1.004	1.013	1.020	1.004	1.034	1.018

Source: Calculated by the researchers

In respect of the technological efficiency change, the mean score in each year is more than one which points to a growth. However, the growth rate is quite low (0.4% to 3.4%). The study period shows an overall technological efficiency change of 1.8%. The districts of Bankura, Burdwan, Mugberia, Nadia and Tamluk-Ghatal show the most consistent performance because either the figure is at least one in all the years or there is a continuous slow improvement over the years.

5.3 Malmquist Index

The third measure that forms the scope of the study is the total factor productivity growth computed using the Malmquist Index which is the multiplicative result of the two performance measures viz. technical efficiency change and technological efficiency change. The overall factor productivity growth during the period is the geometric mean of the individual year-on-year Malmquist indices. Table 3 shows the data.

Table 3: Malmquist Index for Total Factor Productivity Growth

District	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Geo. Mean
Bankura	1.000	1.000	1.023	1.000	1.026	1.000	1.072	1.017
Burdwan	7.085	1.000	0.975	1.026	1.074	1.006	1.041	1.345
Dakshin Dinajpur	1.000	1.000	1.000	0.971	1.022	0.962	1.000	0.993
Howrah	0.970	1.001	0.971	0.986	1.137	0.907	0.937	0.985
Jalpaiguri	1.000	0.996	1.000	1.000	0.925	1.000	1.000	0.988
Malda	0.970	0.993	0.958	1.068	1.004	1.019	1.011	1.003
Mugberia	1.015	0.950	1.063	0.984	0.994	1.123	0.996	1.016
Murshidabad	1.087	1.017	1.090	1.008	0.994	0.973	1.078	1.034
Nadia	1.043	1.088	1.058	1.000	1.034	1.021	1.067	1.044
Purulia	0.894	1.079	0.488	1.967	1.048	0.902	0.937	0.972
Raiganj	0.981	1.030	0.993	1.092	0.891	1.085	0.979	1.005
Tamluk-Ghatal	1.000	1.000	0.909	1.126	1.049	1.073	1.000	1.020
VCCB	0.996	1.076	0.990	0.990	1.065	1.000	1.017	1.019
Geometric Mean	1.158	1.017	0.947	1.073	1.018	1.004	1.009	1.031

Source: Calculated by the researchers

The overall position during the period shows that almost 30% of the districts show a negative growth with only four of the thirteen districts depicting a rise in factor productivity. Burdwan district in this case also dominates with a growth of 34.5%. However, if the first year is excluded for Burdwan, the growth comes down to 1.98%. In most of the other cases, the districts show a low growth that falls in the range of 0.3% to 4.4%. The Malmquist index for all the districts put together shows a productivity growth of 3.1%. PACS of Purulia district show the minimum factor productivity growth of negative 2.8%.

6. Conclusions

The story of cooperative movement in the country dates back to many decades. If we look at the different tiers in the cooperative structure of India, it is clear that there are three tiers which are State Cooperative Banks at the state level, District Cooperative Banks at the district level and Primary Agricultural Credit Societies at the lowest level. The present academic contribution focuses on the performance assessment of the institutions at the lowest tier in the state of West Bengal. The study uses secondary data for the period 2010 to 2017. The researchers focus on the issue of total factor productivity growth. For the purpose, the investigators use three measures to get a total picture of growth which are technical efficiency change, technological change and malmquist index. The catching effect for the

different PACS shows that improvement in efficiency is observed in the case of Burdwan, Mugberia and Murshidabad. There are four districts which show an overall decline which are Howrah, Malda, Purulia and Raiganj. The remaining six districts show stagnation or no growth. In the case of Burdwan, the overall growth of 26.4% is due to the abnormal growth in 2010-11 (415%). If that year is excluded and the result is recomputed, it is observed that even Burdwan experiences a case of stagnation. Hence, the overall condition of PACS with regard to growth in technical efficiency is not that rosy. There is a need for the PACS to focus on increasing efficiency by ensuring better mobilization of funds.

In order to look into the reason behind productivity progress or regress, investigators also look into technological efficiency change. The year-wise figures show that there is a progress over the years though it is quite low at 1.8%. In fact, towards the later part of the study period, there is a progress to the extent of 3.4% in 2016-17. An assessment of the performance of PACS of the individual districts shows that except Dakshin Dinajpur and Jalpaiguri, all districts depict a growth in technological efficiency which varies from district to district. The change is however maximum in the case of Burdwan followed by Raiganj and Howrah districts.

With regard to the total factor productivity growth, the PACS all together experience a rise in 3.1%. An observation on all the districts individually shows that Burdwan is better placed with a rise of 34.5%. However, if we exclude the first year of the study, this district also reveals a similar trend as found in the other cases. But, the productivity growth is very low (close to nil) in most of the cases. With regard to the total factor productivity growth, all PACS together experience a rise of 3.1%. An observation on the individual districts shows that Burdwan is better placed with a rise of 34.5%. However, if we exclude the first year of the study, the district reveals a similar trend as found in the other cases. But, the growth assessment shows a position of stagnation in most of the cases. Thus, the overall picture of PACS provides evidence of the need to do more for PACS. Else they will slowly perish and will be considered as unviable entities.

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An Analysis of Factors Affecting the Performance of General Insurance Companies in India

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Abstract

The insurance industry forms an integral part of a country's financial sector. Insurance companies are important for both businesses and individuals. They are important as they indemnify losses and put them in the same positions as they were before the occurrence of the loss. Insurers provide economic and social benefits in society like mitigating the impact of losses, reduction in fear and uncertainty as well as employment creation.

The Indian insurance industry has seen a change in the market dynamics since liberalization and economic reforms. Though there is an improvement in penetration and density in the last 10 years, India largely remains an under-penetrated market. Studies show that today the insurance market is primarily dependent on push and tax incentives because of which there is mandatory sales of policies. There is very little or no customer pull. The customer pull will come from the increasing savings and disposable income.

Increase in the interest in insurance, innovative product offerings and distribution channels have helped for the growth of the industry. Increasing penetration of the internet has also accelerated demand of insurance products. The Indian insurance market is a huge business opportunity. Despite being the second most populous nation, India currently accounts for less than 1.5% of the world's total insurance premiums and about 2% of the world's life insurance premiums. India is the fifteenth largest insurance market in the world in terms of premium volume, with the potential to grow exponentially in the coming years.

Currently, there are 24 life insurance, 25 non-life insurance and six health insurance companies in the Indian market that compete on prices and services to attract customers. Studies have shown that Demographic factors such as the growing middle-class population, young insurable population and growing awareness of the need for protection and retirement planning will support the growth of the Indian life insurance industry. There are not many studies on the performance of general insurance in India. The present study identifies the gap and examines the factors that affect the performance of General Insurance in India.

2. Review of Literature

Outreville (1998) suggests that the insurance sector plays a significant role in a country's economic growth and offers financial protection to individuals or firms against monetary losses suffered from unforeseen circumstances.

Performance is the ability of an organization to gain and manage its resources in several different ways to develop competitive advantage (Iswatia and Anshoria, 2007). High performance reflects management effectiveness and efficiency in making the use of a company's resources and this contributes to the economy at large (Batra, 1999). Generally, the performance of insurance companies can be estimated by measuring their profitability, which is a relative measure of success for a business and it acts as a proxy of financial performance.

Lack of insurance coverage can leave individuals and families vulnerable to the uncertainties of everyday life and emergencies. Insurance makes possible ventures that would otherwise be prohibitively expensive if one party had to absorb all the risks (Rejda and McNamara, 2014). Insurance provides protection for valuable possessions and assets for the day that an unexpected loss or damage to belongings is experienced. It encompasses all types of insurance policies other than life insurance policies (Rejda and McNamara, 2014).

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Charumathi (2012) defines profitability as the ability of the business to utilize its assets in order to generate revenues in an efficient manner. Studies reveal that the insurance companies profitability is affected by factors which are both internal and external like working capital management efficiency (Jibra, Sameen, Kashif and Nouma, 2016), liquidity ratio, capital adequacy, firm growth rate, size of the company (William, 2012) and even external factors like GDP and Inflation (Fadzlan, 2009).

Ansari and Fola (2013), examined the Indian financial soundness and performance of life insurance industry. They employed CARAMEL model to analyze the variables. According to the result of this study capital adequacy, asset quality, management efficiency, earnings /profitability/and liquidity position significantly vary in private and public life insurance companies in India.

One of the objectives when managing insurance companies is to attain profit (Chen and Wong, 2004). Profits alone cannot be used to compare performance between different companies hence profitability is suitably measured by financial ratios (Abate, 2012).

Al-Shami (2008) and Malik (2011) argued that Return on Assets (ROA) and Return on Equity (ROE) are the best measures of company performance. ROA measures the ability of an insurance company's management to generate income by utilising company assets (Wen, 2010). It is a ratio that indicates profitability of an insurance company. An increasing trend of ROA indicates that the profitability of the company is improving. ROE is a financial ratio that measures the amount of profit a company earned relative to the total amount of shareholder equity invested. Thus, a higher ROE indicates that management is very effective in utilising shareholders' capital (Krawish, 2011).

Kozak (2011) analysed the determinants of the profitability of 25 general insurance companies in Poland from 2002 to 2009. By applying a regression model the author identified the factors; reduction of motor insurance, increase of other classes of insurance, growth of gross written premiums, operating costs reduction, Gross domestic Product (GDP) growth, and growth of the market share of the companies with foreign ownership, as having a positive impact on insurance companies' performance.

Almajali, Alamro and Al-Soub (2012) carried out a study to examine and identify the factors affecting the financial performance of Jordanian insurance companies during the period 2002 to 2007. ROA was used as the dependent variable while leverage, liquidity, age, size and management competence index were independent variables. The results of regression analysis revealed that liquidity, leverage, size of the company and management competence index have a significant and positive effect on the financial performance of Jordanian insurance companies. Results also suggest that there is no significant relationship between the age of the company and performance.

Study in Africa conducted by Derbali, 2012 on “determinants of performance of insurance companies in Tunisia” specifically focused on life insurance companies. Accordingly, company growth rate and age were identified as had a positive impact while company size affecting negatively the profitability of insurance companies. However, variables such as leverage ratio, tangibility and liquidity risk were identified as had no significant impact on life insurance companies` profitability (Derbali, 2012).

Burca and Batrinca (2014) investigated the factors that affect the financial performance of 21 insurance companies operating in the Romanian insurance market during the period 2008-2012. By applying panel data techniques, the authors showed that the major determinants of financial performance in the Romanian insurance market are financial leverage in insurance, company size, growth of gross written premiums, underwriting risk, risk retention ratio, and solvency margin.

The general insurance business in India is currently at about Rs 78,000 crore (US$ 11.44 bn) premium per annum industry and is growing at a rate of 17 %.

The Indian insurance market is a huge business opportunity waiting to be harnessed. Despite India is the second most known populous nation in the world, currently accounts for less than 1.5% of the world‟s total insurance premiums and about 2% of the world‟s life insurance premiums. In terms of premium, India is the

fifteenth (15th) largest insurance market in the world and has a great potential to grow in the future (Bawa and Chattha, 2013).

There are several studies on a multiple linear regression approach that investigated the factors affecting the insurance industry in different countries obtaining different results [Ahmed and Usman, 2011; Charumathi, 2012; Muya, 2013; Mehari and Aemiro, 2013; and Pervan, Curak and Poposki, 2014].

In this article we utilise a combination of multiple linear regression and factor analysis using panel data of general insurance companies in India. We unravel the impact of various independent variables on insurance company performance measured using the ROA.

3. Objectives of the Study

The primary objective of the study is to examine the factors that affect the performance of general insurance companies in India.

4. Research Methodology

The study is based on secondary data collected from the annual reports of the companies, IRDA annual reports, Swiss Re repots, PWC Reports and E&Y reports, annual reports of the individual insurance companies.

The data was collected for the years 2009-2017, a total of 9 years. The sources of these data include financial statements of the selected companies, journals, research papers etc. The annual reports of IRDA, the financials of the companies were collected from CAPITALINE DATABASE and also from the individual annual reports of the respective companies. The financial data collected is analyzed using basic statistical measures, correlation analysis and regression analysis.

A sample of ten general insurance companies (4 public and 6 private are taken) .The private insurance companies are selected on judgmental basis. Ten general insurance companies are chosen to understand the factors that impact the overall performance of the general insurance sector.

5. Overview of Indian Insurance Sector

The potential and performance of the insurance sector is universally assessed with reference to two parameters, viz., insurance penetration and insurance density. These two are often used to determine the level of development of the insurance sector in a country.

(i) Level of insurance penetration which is measured as the percentage of insurance premium in gross domestic product (GDP); and

(ii) Insurance density ratio (wherein insurance density is defined as the per capita expenditure on insurance premium and is directly correlated with per capita GDP).

The potential and performance of the insurance sector is universally assessed with reference to two parameters, viz., insurance penetration and insurance density. These two are often used to determine the level of development of the insurance sector in a country. Insurance penetration is defined as the ratio of premium underwritten each year to the Gross Domestic Product (GDP).

The penetration of the insurance industry has grown to 3.70% in FY 2017-18 compared to 3.49% in FY 2016-17. The penetration of the industry was the highest at 5.20% in FY 2009-10 and 5.10% in FY 2010-11.

Similarly, the insurance density, which was at a high in 2010-11 at $64 has then to $60 and now again increased to $73 in FY 2017-18. The insurance density was at $55 in FY 2015-16, that means density has marginally increased last fiscal.

The insurance industry has been at the forefront of economic development in India. Gross premiums have grown at a CAGR of 7.2% over the last decade, pushing the country's sector into the league of larger insurance economies globally. During this period, the behavior of customers has also changed significantly, with 20-25% of

them now using digital channels to understand and compare insurance products. The performance of the insurance companies is affected by a variety of factors. The present study aims to study the factors affecting the performance of general insurance in India.

6. Research Analysis

Methodology

Data source: Data collected from 7 general insurance companies (3 public and 4 private insurance). Financial report of companies from their respective website and IRDAI taken as a source and collected for 9 years data from 2009 up to 2017, which included 63 observations.

Analysis technique: 63 observations of panel data (cross-sectional and time series) has been analyzed by using Fixed Effect Model after checking the appropriateness of the model by testing Hausman test and Durbin Waston test.

The Regression output generated through Eviews version 7 to test the following model:

$$ROE_{i,t} = \beta_0 + \beta_1(Claims\ Ratio) + \beta_2(GDP) + \beta_3(Inflation) + \beta_4(Liquididty\ Ratio) + \beta_5(Share\ Capital) + \beta_6(Solevency\ Ratio) + \varepsilon_{i,t}$$

Where,

$ROE_{i,t}$: Return on equity defined as the insurance companies after tax profit over equity is the profitability in insurance company *i* at time *t*.

7. Data Analysis

Data collected from 7 general insurance companies (3 public and 4 private insurance). Financial report of companies from their respective website and IRDAI taken as a source and collected for 9 years data from 2009 up to 2017, which included 63 observations.

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Where,

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Descriptive Statistics

The descriptive statistics results for the dependent variable; return on equity and independent variables; GDP, solvency ratio, liquidity ratio, claims ratio, inflation rate, liquidity and equity capital. The minimum, maximum, mean and standard deviation values are included in Table 1. These figures give a description about the data used in the study in order to understand the study variables. The descriptive statistics of each variable which is computed based on the 63 observations recorded for the period 2009 to 2017.

Table 1:

Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.	N
CLAIMSRATIO	84.07556	112.1100	70.41000	8.603533	63
GDP	7.468730	10.30000	5.460000	1.299116	63
INFLATION	7.778889	12.11000	3.600000	2.953033	63
LIQUIDITYRATIO	0.417190	0.760000	0.170000	0.162313	63
ROE	9.693175	42.71000	-30.37	17.34652	63
SHARECAPITAL	316.4605	4450.500	100.0000	548.6290	63
SOLVENCYRATIO	1.989683	3.630000	1.320000	0.593926	63

Multicollinearity Test

A claim is the defining moment in the relationship between an insurer and the customer because it creates a chance to show that the years spent paying premiums were worth the expense. The cost of claim payouts and expenses is the largest spending category for an insurer, accounting for up to 80% of premium income (Harrington, Mann and Niehaus, 1995). The lower the claim ratio the better the profitability because higher claim ratios may indicate poor risk selection and imply that the insurance company will have to pay more.

The rate of inflation typically refers to changes in the overall level of prices within an economy. Few authors have documented the impact of the inflation rate on the non-life insurance industry. D'arcy (1979) found that underwriting profits are correlated with the inflation rate. payment of claims by a company might reflect inflation for example, the value of an asset insured might change price as a result of inflation resulting in the insurance company paying more.

Liquidity from the context of insurance companies is a measure of the ability of an insurance company to pay liabilities. Companies with more liquid assets are less likely to fail because they can realise cash even in very difficult situations. It is therefore expected that insurance companies with more liquid assets will outperform those with less liquid assets.

Studies have investigated the influence of ownership structure on profitability. Equity capital is the capital raised from the owners of a company. More capital influx will enable firms to expand and open new branches. This may lead to growth which is also accompanied by economies of scale and thus improved financial performance (Hansen, 1999).

Multicollinearity test identifies whether there is perfect or strong relationship among explanatory variables or not. Variance Inflation factor is a measure of collinearity among explanatory variables. As VIF is less than 10 for each explanatory variable, it can be concluded that there is no multicollinearity among them. Many authors accept that the VIF below 10 has no serious problem of multicollinearity (Hair et al. 2006).

	CLAIMS RATIO	*GDP*	*INFLATION*	*LIQUIDITY RATIO*	*SHARE CAPITAL*	*SOLVENCY RATIO*
CLAIMSRATIO	1					
GDP	0.16	1				
INFLATION	0.07	-0.29	1			
LIQUIDITYRATIO	0.28	0.27	-0.4	1		
SHARECAPITAL	0.02	0.03	-0.12	0.06	1	
SOLVENCYRATIO	0.02	0.27	0.18	0.21	0.16	1

Variable		**Collinearity Statistics**	
		Tolerance	**VIF**
	sharecapital	.965	1.037
	liquidityratio	.725	1.379
	solvencyratio	.884	1.131
	claimsratio	.864	1.157
	gdp	.801	1.248
	inflation	.796	1.257

Regression Output:

Dependent Variable: ROE
Method: Panel Least Squares
Date: 12/18/18 Time: 12:10
Sample: 2009 2017
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	131.1908	17.53738	7.480638	0.0000
CLAIMSRATIO	-1.168135	0.173155	-6.746192	0.0000
GDP	1.672050	0.955101	1.750653	0.0861
INFLATION	-0.508462	0.527943	-0.963100	0.3401
LIQUIDITYRATIO	52.01695	19.79710	2.627504	0.0114
SHARECAPITAL	0.001920	0.002129	0.901707	0.3715
SOLVENCYRATIO	3.186553	2.709446	1.176090	0.2451

Effects Specification			
Cross-section fixed (dummy variables)			
R-squared	0.827872	Mean dependent var	9.693175
Adjusted R-squared	0.786561	S.D. dependent var	17.34652
S.E. of regression	8.013993	Akaike info criterion	7.181842
Sum squared resid	3211.204	Schwarz criterion	7.624076
Log likelihood	-213.2280	Hannan-Quinn criter.	7.355775
F-statistic	20.04012	Durbin-Watson stat	1.325416
Prob(F-statistic)	0.000000		

From the above regression it is observed that Claims ratio and Liquidity ratio are statistically significant at 5%, while GDP is statistically significant at 10%. Other variables such as inflation, share capital and Solvency ratio showed insignificant effect on ROE.

Conclusion

The industry shows signs of stress but there is a silver lining. The insurance industry stands at the threshold of moving toward a stable and profitable growth. Most players are now looking to reassess the entire business model from product, pricing, risk management, acquiring rural customers, distribution, claims and fraud management. They are aiming at a realistic pace of growth. The industry is also moving towards consolidation, i.e., mergers and acquisitions.

The study shows that claims ratio and liquidity ratio have a significant affect on the ROE and the other factors like GDP, inflation, solvency, capital etc., do not have a huge impact on the performance of general insurance companies.

The growing awareness of the need for protection, the need for retirement planning, growing middle class and the huge young insurable population of our country will help and support the growth of insurance industry in India. The insurance companies help in the creation of a more stable operating environment for businesses and thus allows companies to concentrate on their core business. The insurance companies should work towards better performance, increasing the penetration of insurance to rural and underpenetrated areas and increasing the contribution to the economy.

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Age of Transformation: Emergence of Artificial Intelligence for Manufacturing Industries

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Abstract

We may be witnessing major transformational change in this age of computation of manufacturing and processing. The rise in consumer demand has affected major industries throughout the world. Therefore, the need for a catalyst for instigating such hyper changes has been felt by every element involved in such process. The need for artificial intelligence has seen a boom in last few years with more funds available for research and development of implementable concepts into acceptable and feasible designs. This paper is an effort to understand how artificial intelligence has developed in recent years. Also, there are different aspects of manufacturing and allied activities that can be transformed sincerely for innovation, maximizing time-output ratio including quality control.

Keywords: AI, Neural Network, Business Efficiency, Intelligence

1. Introduction

The 4th Industrial Revolution has been recognized as the most dynamic socio-economic transformation that humanity has ever faced of yet (World Economic Forum). There are so many enduring technology-based changes that are touching business across different nations around the world. These include cars with auto driving mechanism, connected devices, AI driven high tech computer micro and nano chips, mobile internet technologies along with rapid multi dimensional innovations that indicate this colossal shift to the new era.

As compared to the prior industrial revolution, manufacturing is the centre stage of several of these pioneering advancements in manufacturing sector. In general, manufacturing is considered as being naturally inclined to transform, with the intent of making things easily affordable and gain competitive advantage in the market. Experts all over the world agree the next big change will be the use Artificial Intelligence in manufacturing, more popularly now being called as smart manufacturing. As predicted by the global giant Accenture, key industrial applications of Artificial Intelligence have high probability of being the most disruptive due to the high levels of global competition. This fact has also been ascertained by 92% of manufacturing executives, thereby confirming that AI is surely going to the ultimate drivers of innovation in the space (https://www.iflexion.com/blog/ai-manufacturing).

Recent growth in artificial intelligence (AI) has enthused passionate interest from private sector and public sector and governments all across the globe, as they anticipate higher likelihood of bulk-produced consumer product machinery with super humanlike intelligence a reality in near times. While AlphaGo deepmind became the first computer program to defeat a professional human Go player capturing headlines all across the globe, there are many other real breakthroughs in AI waiting or are in the process of taking place in near future. There are many impressive developments in AI–based computer programs that have made such technologies, which can learn and wisely respond including decision making in different ranges of real time areas and applications.

Some of the instances of preliminary growth of AI can be people visiting shopping websites and getting emails, alerts on predictable products, services later based on network of algorithms running in the background that records, processes and analyses the data of such online behavior:

There has been literature on current advances in AI and the consequential implications related to jobs, skills, allied sectors and society, not much analyses has been conducted on the explicit impact of AI on India's promising economy. Also, India must surely and transitionally create workforce and environment to adopt based on

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a programmed framework of national policy to propel AI growth, innovation, adaptation, and propagation in various sectors and not just concentrating on merely consumer goods and information technology (IT) services. AI's inclusion shall bring in new distinctive opportunities with challenges for India, both in the short, medium and long term periods.

Therefore, the goal of this paper is to understand how the concept of AI can be applied in various manufacturing applications so that Indian manufacturing companies can fulfill the necessary requirements for its successful implementation and development.

2. LITERATURE REVIEW

The technology of AI has been a point of discussion for the university researchers for around 30 years. It has been seen that the Japanese have shown the world business community the successes in the form of manufacturing steel, cars, electronics, and computer chips. In recent times, Japan declared their Fifth Generation Project goal, "think", there were instantaneous reactions from the rest of the world. The U.S. Government also came up with programs such as the Defense Advanced Research Projects Agency (DARPA). Also, the Britain started the Alvey Committee and European community formed European Strategic Programs for Research and Development in Information Technology (ESPRIT).

During the early stages in 1960's, work on AI experienced a rise in fame when some relatively audacious claims were made about future capabilities which may emerge, more in the vicinity of machine translation. As these claims could not occur as thought, research funds also became scant. These were later activated in some ways with the Japanese declaration of their Fifth Generation Project. In the 21st century AI has developed into an important domain of research in practically all categories that includes science, engineering, medicine, business, accounting, finance, marketing, economics, stock market, education and law, including others (Halal (2003), Masnikosa (1998), Metaxiotis et al. (2003), Raynor (2000), Stefanuk and Zhozhikashvili (2002), Tay and Ho (1992) and Wongpinunwatana et al. (2000)). Tracking of such AI expansion has become a very difficult task (Ambite and Knoblock (2001), Balazinski et al. (2002), Cristani (1999) and Goyache (2003)). There are many other fields of knowledge which are being looked upon as AI applications tend to increase (Eiter et al. (2003), Finkelstein et al. (2003), Grunwald and Halpern (2003), Guestrin et al. (2003), Lin (2003), Stone et al. (2003) and Wilkins et al. (2003)).

Both business and non-business using information technology are now considering a major shift to AI clearing major obstacles and hindrances in the path of applications (Barzilay et al. (2002), Baxter et al. (2001), Darwiche and Marquis (2002), Gao and Culberson (2002), Tennenholtz (2002) and Wiewiora(2003)). One of the main motivators for AI caters to requirements of new players to understand the basic structure of AI literature (Brooks (2001), Gamberger and Lavrac (2002), Kim (1995), Kim and Kim (1995), Patel-Schneider and Sebastiani (2003) and Zanuttini (2003)).

Literature points towards different areas of AI that can be divided into sixteen categories (Becker et al. (2000), Singer et al. (2000), Chen and Van Beek (2001), Hong 2001) and Stone et al. (2001)). These are reasoning, programming, artificial life, belief revision, data mining, distributed AI, expert systems, genetic algorithms, knowledge representation, systems, natural language understanding, machine learning, neural networks, theorem proving, constraint satisfaction, and computation theory (Peng and Zhang (2007), Zhou et al. (2007) and Wang et al. (2007)).

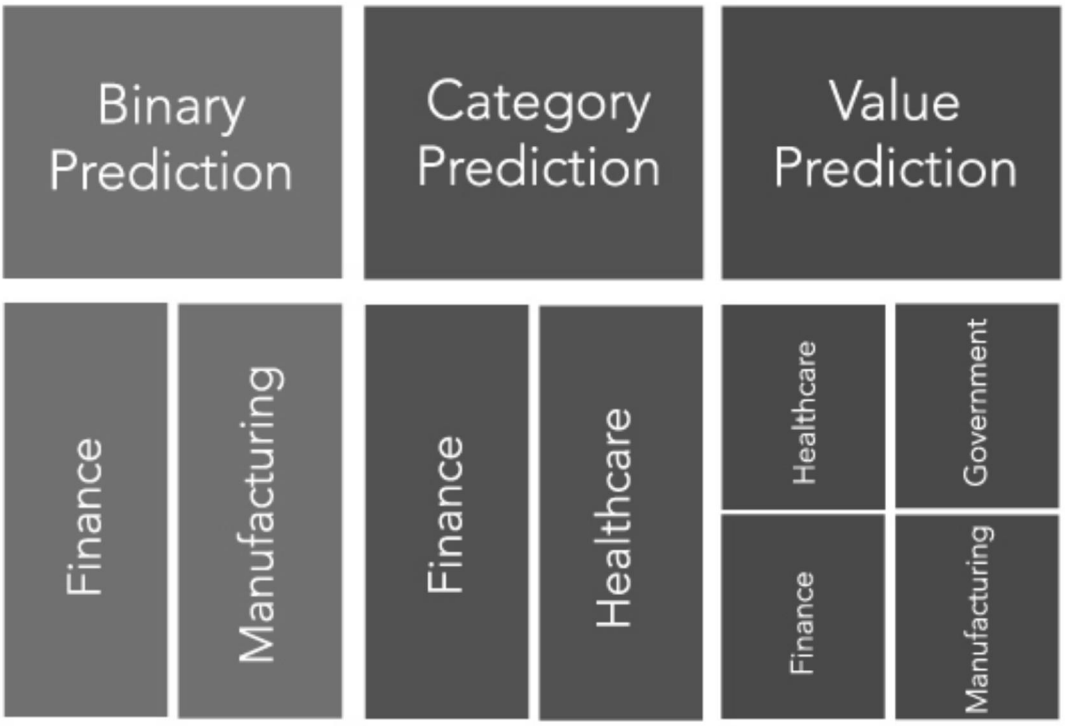

Figure 1. Prediction types for different sectors

(Source: https://www.cloudtp.com/doppler/hot-topics/ai-is-here-and-it-will-change-everything/)

The objectives of the study are as follows:

a. To identify different aspects of AI.

b. To understand the characteristics of AI in manufacturing process.

c. To observe the trends in AI applications in manufacturing and allied sectors.

d. To understand availability of funding in AI research in manufacturing.

I. Research Methodolgy

In this research paper, our intention was to identify the practicalities of AI applications in manufacturing sector. To understand this, we have collected secondary data from a range of published sources such as journals, published reports. Some tables and figures have also been used based on secondary data sources. The trends were also collected from reputed sources and were acknowledged. A preliminary investigation helped in construction of the literature review and observation technique was used to build the periphery of discussion and analysis.

II. Discussion and Analysis

4. A. Areas of AI Applications

In manufacturing, there are different areas where manufacturing and allied brands can explore these as separate AI projects:

1. AI- based Maintenance Systems
2. AI- controlled Supply Chain Management
3. Automated Yield Optimization using AI
4. Fault Detection / QA Automation using AI

5. AI controlled Facility Operations
6. AI managed Staffing

• Maintenance AI- based Maintenance Systems

Different AI techniques such as machine learning with neural networks and fuzzy logic lead to predictive maintenance. Predictive maintenance can be defined as a technique to forecast or anticipate the future failure point of machine components, so that such can be replaced just before it reaches failure stage, according to planned arrangement. This helps in minimizing of equipment downtime along with maximization of component lifetime. In this technique, different parameters are measured continuously so that connections can be predictable within the component life cycle. An example can be readings of the vibration of a bearing at regular intervals until the component fails. This involves using machine learning techniques using training, testing and validation of samples for future estimation of possibility of component failure with immediate replacement of such component

(http://www.mantenimientopetroquimica.com/en/rcm/144-articles-of-interest/100-what-is-predictive-maintenance.html).

As per suggestions of Deloitte, an AI-based predictive safeguarding system can enhance equipment uptime by 10%-20%. Also, it can decrease material expenses by 10%, along with reducing maintenance planning time around 50%. This may lead to trim down maintenance costs by at least 10%. This may be millions of dollars of savings every year, with a very high returns on investments if all planned operations are managed smoothly.

• AI-controlled Supply Chain Management

In general, a complex manufacturing process can involve several thousands of parts of systems and sub-systems.. These processes may be sourced, delivered to different parties, and needs to safely maintained in inventory. This supply chain must be kept highly purposeful and equipped which can lead to lean manufacturing.

Machine learning is considered the most important activity in the domain of supply chain. According to Adeel Najmi (chief product officer at Symphony Retail AI), machine learning takes place when a machine reads the output, supervises the output accuracy, and continuously updates its own algorithmic model so that improved outputs can be achieved in future. He also contemplates that these may or may not always require use of data science techniques. He emphasizes on the ability of the machine to learn with experience and not just concentrate on just neural networks or some other form of supervised or unsupervised learning technique

(https://www.forbes.com/sites/stevebanker/2019/01/01/20-things-to-know-about-artificial-intelligence-for-supply-chain-management/#279520e75371).

Also, Machine learning is estimated to reduce costs related to transport and warehousing and supply chain administration by 5 to 10% and 25 to 40%, respectively.

• Automated Yield Optimization using AI

In modern times, most manufacturing concerns think on finding innovative ways to grow, improve at product quality and at the same time with short lead-time production fulfillment for customers. As per a recent survey by World Economic Forum (WEF) and A.T. Kearney, the future of production lies in how manufacturers are considering pool suitable emerging technologies including Internet of Things, AI, and machine learning that can lead to accuracy of asset tracking, visibility of supply chain, and optimization of inventory (Technology and Innovation for the Future of Production: Accelerating Value Creation, World Economic Forum with A.T. Kearney).

• Fault Detection / QA Automation using AI

One of the most common methods used by Multi national corporations is Automation testing where test automation software is created and operationalized for automated tests for detection of faults and errors (https://www.softwebsolutions.com/resources/qa-automation-consulting-services.html). In real time, it has been observed that even cloud technologies like Selenium Grid are vulnerable in terms of lags in execution time, based

on the frequency of nodes running, actual memory used , and the frequency of concurrent tests. Cloud computing enables to increase the ability to execute swift multi level scaling of applications, (up and down), depending on the application workload, with sharing information across all implementable instances. Optimized solutions sought by testers can be achieved with the very high bars if AI is infused for large scale improvement in such processes. Acceptance criteria for such can be:

1. Such tests should be executable at scale, within the cloud, to create more efficient and reliable solutions with every consequent run and release.
2. Such tests should not be location specific but rather be executable from any place around the globe, be device, independent with different levels of bandwidth, and suitable for all possible environments.
3. Speed tests should be easy even for the most complex problems and should take minimum executable minutes and not stretch to longer or indefinite periods of time (https://dzone.com/articles/ai-in-test-automation)

• AI controlled Facility Operations

Facilities Managers face a very complex task of over viewing and recollecting details linked to everyday operations. AI in facilities management enhances the ability of systems to use self-optimizing systems, power-driven by the Internet of Things (IoT), reduces machine -work time for team members. For instance, self-vacuuming and self-mopping devices are using AI to chart out a floor, clean them, and return to docking station upon completion of predetermined work (Source: http://blog.qsifacilities.com/artificial-intelligence-in-facilities-management).

AI provides supplementary view into and much larger span of control over environmental and facility controls, along with realizing these benefits:

1. AI can open new source revenue. For instance, minimizing energy usage to construct a net-zero energy location can efficiently double capital planning ability.
2. Improved predictability and Demand forecasting through AI can improve preventative maintenance planning. Also, predictability, facilities Managers can strategically segment capital and operational costs, thereby controlling overall facilities expenditures.
3. Automated Reporting and Self-Optimization can detect potential problems before they can take place. AI leads to automated reporting and scheduling of work orders, that includes input of data into a computerized maintenance management system (CMMS), as and when integration is required.
4. AI using IOT helps in integration virtually with any system that is interconnected. This can lead not only to easy reporting but also can be stored and processed in cloud-based technologies, Therefore, IOT systems connected systems can combine with more systems and augment potential savings.
5. AI enhances inhabitant experiences by locating potential risks. Reduction in poor facilities management can lead to higher profitability; it can result in reducing health problems, like severe allergies or uncomfortable work conditions. AI can smoothly recognize these risks in the same way as identifying probable equipment malfunctions.

• AI managed Staffing

New opportunities can arise when AI facilitates recruiters by increasing hiring time more efficiently and managing candidate preliminary short listing and selection. Large datasets can be worked upon using machine learning to perform tasks and gather insights, AI solutions can also provide necessary support during many diverse stages of the recruitment process (https://medium.com/the-future-of-staffing/how-can-ai-help-staffing-agencies-cce8cce179e7).

AI tools can also be flexibly used for increasing human effectiveness and endeavor in the sourcing process.

Software based solutions can provide help companies by writing suited job descriptions with language analysis and providing suitable recommendations for hiring outputs that the system has processed.

Chatbots using Natural language processing (NLP) is a foundational concept in AI. It refers to a machine's ability to create information based on analyzing human language. AI can be applied to gather highly specific information from visual data. Statements and facial expressions can be analyzed to give recruiters data about potential dishonesty or emotions like contempt or surprise (interview process using skype). Subjective factors like culture fit are still too difficult for computers to interpret, and there are still many developments to be made in natural language processing and sentiment analysis. AI is, however, still improving rapidly thanks to the constant generation of new data in the world (https://medium.com/the-future-of-staffing/how-can-ai-help-staffing-agencies-cce8cce179e7)

4. B. Trends of AI in Manufacturing

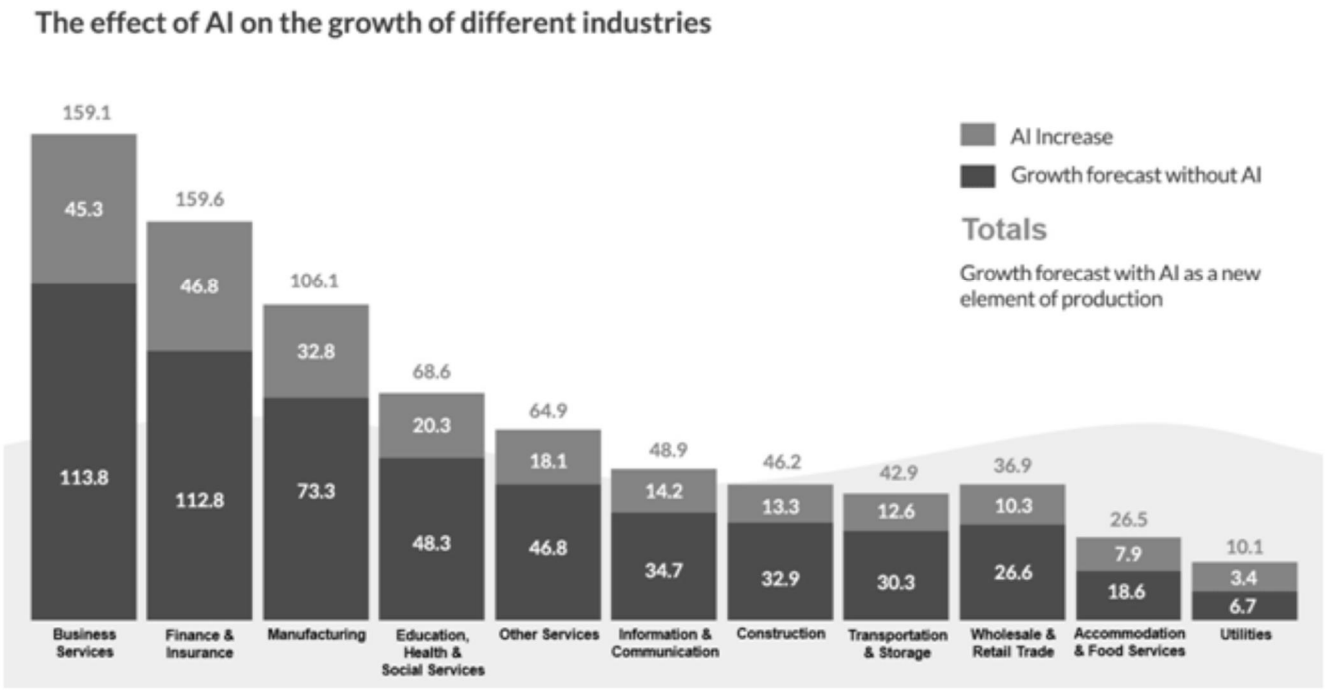

Figure 2. Growth prediction of AI in the year 2035 (Source: https://www.plantautomationtechnology.com/articles/the-future-of-artificial-intelligence-in-manufacturing-industries

As seen in figure 2, forecasts have been made for different sectors including manufacturing sector where growth forecast without AI stands at $73.3 US billion. With AI, manufacturing forecasts have been made to around $32.8 US billion i.e. an additional 44.74% of the base estimate. An area where the impact is already visible is quality assurance where computer visualization enhancements using AI algorithms are detecting product defects with greater efficiency. Another important aspect can be to detect efficiency of factory employees with accuracy for compensation determination. Also, factory workers can gather raw materials from the shelf with automatic stock recording and updation without any manual process been involved. AI is also capable of tracking causes and reasons by analyzing variety of data captured using IoT. This can lead to generation of new ideas and unimaginable solutions for manufacturing and logistical problems.

4. C. Funding in AI Research in Manufacturing

Since a long time, funding has always been a critical issue for AI research. Although, in the initial stage of 1960s the AI concept could not proceed more than just a concept, recent trends indicate massive funding fueled from high growth potential companies and emerging AI based startups are optimistic in redesigning of the industrial

framework. In 2017, around US$12 billion of venture funds raised in US and Chinese companies. Based in Japan, Softbank managed to gather US$100 billion, from many international investors, which also included Saudi Arabian investors. US companies have also raised US$1.2 billion with silicon valley's VC funds. Chinese startup, SENSETIME also garnered more than US$1.2 billion with additional US$1 billion also being raised up (https://medium.com/cognilytica/the-race-for-ai-dominance-is-more-global-than-you-think-e01a0c34d64e).

The two major powerhouses in AI have been China and USA. On one hand, China has multi billion dollar companies such Alibaba, baidu, Tencent and Huawei technologies which are heavily interested and continue to invest huge funds in AI research. These companies have received healthy support from their own government which has already embraced the use of facial recognition. On the other Side, the US companies such as Google, Microsoft, IBM, facebook, Amazon, Apple, and other firms have phasewise invested trillions of dollars into AI research (https://medium.com/cognilytica/the-race-for-ai-dominance-is-more-global-than-you-think-e01a0c34d64e).

I. Research Findings and Conclusion

Some of the major findings of this research can be summarized as follows:

1. AI- based Maintenance Systems, AI- controlled Supply Chain Management, Automated Yield Optimization using AI, Fault Detection / QA Automation using AI, AI controlled Facility Operations, AI managed Staffing are some of the major areas of manufacturing where continuing research is going on in the field of AI.
2. Manufacturing with AI shows a major boost in manufacturing production as seen in figure 2 (almost 44 %).
3. Funding for AI is on ever increasing rate, with global powers like US, China, Japan integrating AI research as a part of their future transformational plan.
4. The future prospects of AI have just begun with more major and significant transformation of manufacturing sector yet to be seen in India and worldwide.

II. Suggestions

In India, AI implementation can start with Make in India program as has been initiated by government of India. It must generate special advantages for manufacturers, that can include soothing rules and regulations along with removing trade barriers, so that the following can be achievable:

- More investments are needed in automation research within the country by building special research laboratories and engineering design studios in next two to three years.
- They must initiate region-based innovation clusters, districts, and corridors by structuring strong networks around manufacturing automation and robotics between educational universities and new businesses in India.
- They must raise ideas to make India a global center for machine intelligence based innovation in manufacturing and allied areas. Larger MNC's should work on PPP (public –private partnerships) to align AI implementation policies with actual implementable plans to be carried out by private companies.

III. Future Work

We know that our current research is based on secondary sources which highlights the prospect of AI in manufacturing and allied areas. In future, one may try to conduct a much in depth analysis of the manufacturing sector that shall lead to understanding of certain areas of manufacturing and need for AI implementation in those areas.

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A Fast Heuristic Method for the Job shop Scheduling Problem with Makespan Objective

Dr. Pritibhushan Sinha*

Abstract

In this paper, a heuristic solution method for the job shop scheduling problem, with the objective of makespan, is suggested. The method is based on an optimal result, for a single machine sequencing problem. With such a priority rule, a special type of perturbations is combined. Experimental results show satisfactory performance of the heuristic method, in terms of being near to an optimal solution. Moreover, the heuristic method has a worst case polynomial bound on time requirement and is quite fast on average.

Keywords: Job shop Scheduling, Makespan, Heuristic Method, Solution Efficiency & Speed

1. Introduction

Scheduling problems are important for manufacturing or service organizations, trains and other vehicles scheduling, computer systems designing, etc. An important type of scheduling problems is the general job shop scheduling (see, e.g., Blazewicz et al. 1996, Pinedo 2002). In it, there are n jobs and m machines. Every job has a required route, through the machines. There can be various objectives as makespan, number of jobs completed within due dates, total of tardiness, total of lateness, etc. Other conditions as sequence-dependant processing times, uncertainty, and others, may give many variants. In this paper, we consider the standard job shop problem, with makespan as the objective. Makespan is the time in which all the operations of the jobs are completed. We may describe the problem in a more specific way as in the succeeding.

There are m machines, indexed as $i = 1, 2, \ldots, m$; there are n jobs, indexed as $j = 1, 2, \ldots, n$. Every job has a route, possibly different from that of other jobs, through the machines. A route may be considered as an ordered set, elements of which are integers, $k,\ 1 \le k \le m$. The time requirement of the operation or processing of the *j-th* job on the *i-th* machine is denoted as p_{ij} (≥ 0). An operation once started on a machine cannot be interrupted. A machine cannot do more than one job at a time. If the operation of a job is completed on a machine, it waits before the next machine (or, somewhere as suitable), as required in its route, and is started at the earliest possible time point possible in that machine. Transfer or loading/unloading of a job does not require any time. All the machines and the jobs are ready initially. Let M denote the makespan of a schedule, which specifies a sequence of jobs for every machine. It is the sequence in which the machine processes the jobs. A schedule that minimizes M has to be determined. A linear integer programming (ILP) formulation of the problem may be as in the succeeding (see, e.g., Applegate and Cook 1991). It is considered in it, without loss of generality, that every job is to be processed on all the machines. We denote it as ILP1.

Minimize M

Subject to,

$x_{lj} \ge x_{kj} + p_{kj}$, if l-th machine is immediately after the *k-th* machine in the route of *j-th* job;

$x_{lj} + A y_{ijq} \ge x_{iq} + p_{iq}, \forall i, \forall j, \forall q, j < q;$

$x_{ij} + p_{ij} \le x_{iq} + A(1 - y_{ijq}), \forall i, \forall j, \forall q, j < q;$

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$$M \geq x_{ij} + p_{ij}, \forall i, \forall j;$$

$$x_{ij} \geq 0, \forall i, \forall j;$$

$$y_{ijq} = 1 \text{ or } 0, \forall i, \forall j, \forall q, j < q.$$

Here, in addition to other symbols, x_{ij} denotes the time j-th job is started in the *i-th* machine. A is a sufficiently large number, which may be an upper bound of the optimal makespan. $y_{ijq} = 1$ implies *j-th* job precedes *q-th* job in the *i-th* machine; $y_{ijq} = 0$, otherwise.

The problem, which is strongly NP-hard (see, e.g., Lawler et al. 1993), is difficult to solve. There are some solution methods, as discussed in the literature, of the job shop scheduling problem with makespan as the objective. The problem may be solved exactly with solving the preceding ILP formulation, or other such formulations, with branch & bound (B & B) or cutting plane methods (see, for instance, Applegate and Cook 1991). Dynamic programming also has been discussed by Grromicho et al. (2012) as an exact method for the problem. However, exact methods may take prohibitively large time, even for moderate instances. As such, in practical situations, often heuristic methods, which do not take much time, only are possible to be used. Some heuristic methods are based on priority (or, dispatch) rules. A priority rule is a rule, used to resolve conflicts and schedule the processings on the machines. Giffler and Thompson (1960) have given such a method, which has been used often. The method uses simple randomization as the priority rule, though. In the method, many sub-optimal schedules are avoided; yet, it may not be quite time efficient, particularly for large instances. Another heuristic method for the present problem is the "shifting bottleneck heuristic," first given by Adams, Balas and Zawack (1988), and the original method modified by other researchers (for instance, Carlier and Pinson 1989) later. However, such a heuristic method may take much time too, and may not even give a feasible solution sometimes. Meta-heuristics as simulated annealing (e.g., Laarhooven et al. 1992), tabu search (e.g., Nagata and Ono 2018, Taillard 1994, Zhang 2008), genetic algorithms (e.g., Al-Hakim 2001, Spanos et al. 2014), which use random searches in different ways essentially and switch to relatively worse solutions sometimes, have been suggested. The performance, with reference to solution efficiency, has been observed empirically to be satisfactory for such methods. Allowed sufficient time (often less compared to exact methods), such a method, designed well, should get an optimal or a near optimal solution, for most of the practical instances. However, such methods have high theoretical worst case time bound, or, lack a provable such a bound.

In this paper, we suggest a heuristic solution method for the problem. The method is based on an optimal single machine sequencing result. Application of the result as a priority rule seems to work quite effectively. We also use random perturbations or search in the method. Combination of these gives good empirical results, for the instances, which may be considered to appear frequently in practical contexts. When time requirement is important, the method should be highly suitable.

We organize the rest of the paper in this way. First, the single machine result is given. In the next section, we describe the present heuristic method. Following, the numerical experiment and the experimental observations are described. We conclude with a discussion of some relevant important issues.

2. A Result on Single Machine Sequencing

We give an optimal result, which we use subsequently, for a single machine sequencing problem.

We consider a single machine problem, which may be described in this way. There are n jobs, each of which is to be processed in a machine. The *i-th* job has the processing time requirement of pi (≥ 0). After the processing in the machine, a job spends a time of qi (≥ 0) in the system (in an alternative description, is processed by another machine, such machines being different for each job). The latter additional times may be, for example, cooling times. Every job has the same release date, so that it may be considered that all jobs are ready in the beginning. The machine, too, is ready at the beginning. We consider the objective of makespan, the time at which all jobs have been completed, and it is to be minimized. A more generalized version of the problem, where every job may not have the same release

date is NP-hard (Carlier 1982, Garey, and Johnson 1978). We give an efficient solution method for the problem that we consider.

Solution Method (Single Machine Sequencing)

Suppose, there are 2 jobs. Job 1 is processed first. Then, job 1 is completed on $(p1 + q1)$ and job 2 on $(p1 + p2 + q2)$. The makespan is $\max\{(p1 + q1), (p1 + p2 + q2)\}$. If job 2 is processed first, makespan is $\max\{(p2 + q2), (p2 + p1 + q1)\}$. If $(p1 + q1) \leq (p2 + q2)$ and $q2 \leq q1$, processing job 1 first minimizes the makespan. If $(p1 + q1) \leq (p2 + q2)$ and $q2 > q1$, processing job 2 first minimizes the makespan. Thus, for 2 jobs, sequencing according to descending order of q values minimizes makespan. If $q1 = q2$, any of the jobs can be placed first. When there are n jobs, if, in the sequence, an immediately preceding job has larger q, by interchanging the two adjacent jobs, one gets a solution that has makespan equal or less. So, there exists an optimal solution where the jobs have q values in the descending order. Furthermore, if two adjacent jobs have the same q, interchanging the positions of the jobs, we get a solution with the same makespan. Thus, an optimal sequence is obtained by scheduling the n jobs in the descending order of the q values, breaking any ties arbitrarily.

Example 1: Suppose there are 5 jobs. Processing times and cooling times are as (10, 6), (12, 6), (9, 7), (10, 5), (5, 4). (First number in () is processing time, the second is the cooling time.) All jobs are ready at the beginning. Then, an optimal sequence is job 3 - job 1 - job 2 - job 4 - job 5 (job 3 is processed first, then job 1, etc.). Optimal makespan is 50.

Example 2: We consider the same example as above, but there are different job release dates. The release dates are included as the third number, (10, 6, 7), (12, 6, 8), (9, 7, 5), (10, 5, 6), (5, 4, 7). Every release date is 5 or larger. We ignore the release dates and get an optimal solution, which may be the earlier sequence. We see that, if the processings start at time = 5, the release date is on or before the start time, for each job. So, the sequence is optimal, even considering the release dates. In some instances of the problem, we may obtain an optimal solution, even if the release dates are not the same, with the method.

In the method, n numbers are to be sorted only. So, the computational complexity of the method is $O(n^2)$, or with a more efficient search $O(n \log n)$.

3. Heuristic Method for Makespan Job Shop Scheduling

We use the preceding result in the heuristic method for the jobshop scheduling problem for intuitive reasons that are clear. Indeed, it does not guarantee an optimal solution for the problem. The heuristic method may be described in this way.

Heuristic Method

Initialization: Iteration = 1. Best Solution = A sufficiently large number

Step 1. For Iteration > 1, assign weights to the jobs according to the completion (finish) times in the preceding solution. The largest completion time job gets the highest weight (randomly distributed in [1, 6)), and the weight decreases linearly with rank of completion time, the minimum completion time job having the weight of 1.0. Break ties according to job indices, with less index having higher priority. For Iteration = 1, all weights are 1.0. All jobs and machines are ready at the start of an iteration.

Step 2. Check which machines and which jobs are ready for the next processing.

Step 3. For any machine, which is ready, consider the jobs which are ready and for which the next operation is on this machine. For each one of such jobs, multiply its (total processing time still left – processing time on this machine) with the weight assigned. (If it is the last operation for the job, the value, thus, is zero.). Take the job, which has the highest this value and place the job on the machine. Ties are broken according to job index, with lesser index job being given higher priority. The job and the machine that are scheduled are set not ready.

Step 4. Consider the completion times of all jobs placed on machines. Calculate the minimum of these. All machines

and all jobs with this value of completion time is set ready for the next processings respectively.

Step 5. Repeat Step 2, 3 & 4 till all the processings are placed. Calculate completion time for every job. Maximum of these is the makespan.

Step 6. If the makespan is less than current best solution, update current optimal with the present makespan and update the best schedule. Set, Iteration = Iteration + 1. Repeat till N iterations are done and output results.

In the method, every iteration gives a feasible schedule, because only ready machines and jobs are considered. Consideration is given to decrease completion times of the jobs that are ready; and of the jobs ready, one is placed. Sometimes, this may introduce some inefficiency of the schedule and placing no job might have been better. Weights, dependant on finish times, lead to perturbation of a solution. The intuitive reason for such weights is to give higher priority to start these earlier, to jobs that have higher finish times, leading to higher makespan.

Although, random weights are assigned, the method, when N is a polynomial of m & n, has worst case computational time bound, which is polynomial in m & n. This is because, polynomial number of computations are done in Steps 1 – 5. Step 1 is done once in an iteration and Steps 2, 3 & 4 are repeated. In every m repetitions of Steps 2, 3 & 4, at least one job is placed on a machine. This can be seen, considering basic computations, that, a worst case upper bound on time requirement is, $O(N m^3 n^2)$. It is assumed that, the time for generating a random number is constant. Average time requirement should be much less than the worst case bound. Memory space requirement of the method is $O(m n)$.

The method has been implemented with a computer program, written in Visual Basic, in MS Excel 2007. The method is illustrated with an example next.

Example 1: Let there be 3 machines (M1, M2, M3) and 3 jobs (J1, J2, J3). The sequence and the processing times for J1 are (M1, 3), (M2, 2), (M3, 4); J1 is to be processed first in M1, in which processing time requirement is 3, and so on. The same for J2 & J3 are, (M2, 4), (M1, 2), (M3, 4); (M1, 3), (M3, 2), (M2, 2).

In Iteration 1, first, it is seen that J1 & J3 can be started in M1. Of these, J1 requires 6 units of time in the rest of the processings; J3 requires 4. Hence, J1 is started in M1. Only J2 can be started at the beginning in M2 and it is started there. Of the machines with jobs, earliest, J1 is completed at time = 3. Finish time for J2, till this point, is 4. At time = 3, J1 is ready for M2; but M2 has J2; but J3 can be started on M1. Next, considering the machines with jobs, we see that M2 has J2 and it is completed at time = 4. Now, M2 and J2 also become ready. J1 can be started at M2. So, it is started in it. Of the machines with jobs, both are completed on time = 6. So, all machines and jobs are ready now. J1 & J3 can be started in M3; but, J1 has processing time left as 0, and that for J3 is 2. So, J3 is started in M3, J2 on M1, M2 remains idle. Both jobs are completed at time = 8, and all machines and jobs are ready. J1 and J2 can be placed in M3. Both have further processing time of 0 (last tasks); by index priority J1 is placed in M3. J3 is placed in M2. J2 is completed at time = 10. J1 is completed at time = 12. After that, J2 is placed in M3 and is completed at time = 16. All processing are placed and the iteration is over. Finish times for the jobs are as, J1 – 12, J2 – 16, J3 – 10. Maximum of these is the makespan of the schedule and it is 16. The schedule is, M1: J1-J3-J2; M2: J2-J1-J3; M3:J3-J1-J2.

In the next iteration, the preceding finish times are considered to give weights. Weights are given in the way, as described earlier. These weights are used as multipliers for processing time required subsequently, and of conflicting jobs, a job having the/a highest of these values is placed in a machine.

The iterations proceed as this and 10 iterations are carried out (with a computer program). But the solution is not improved and the final solution obtained is with the same makespan. However, Giffler and Thompson (1960) method, with 9 iterations, gives a solution with makespan of 15. By B & B method with ILP1, it is seen that this is optimal.

4. Numerical Experiment

We conduct numerical experiment with benchmark and randomly generated instances. We have used N = 1000 m

n. We have implemented the heuristic method in Visual Basic in MS Excel 2007. A personal computer with 1.90 GHz processor, 4.0 GB RAM and Windows 8.1 operating system is used for the experiment.

4.1. Benchmark Instances

We solve 10 benchmark instances. The benchmark instances are taken from "OR-Library" <http://mscmga.ms.ic.ac.uk/info.html>. Such instances have been first presented, and frequently used later, in research articles related to the current problem. In these instances, every job is processed in all the machines. We use the following index for solution quality.

Efficiency (%) = [1 – (Solution Value – Optimal Solution Value)/Optimal Solution Value] 100.

For each instance, the method is used three times and the average Efficiency and time requirement is seen. Although, except for MT20, same solution is obtained in almost the same time in the three trials, for all instances. We also solve these 10 instances with Giffler and Thompson (1960) method (abbreviated as GT Method subsequently). The same number of iterations is used for both the methods and GT Method is also applied three times for an instance. The performance of the methods is given in Table 1. We see that, with the present heuristic, in 2 instances optimal solutions are obtained, in 7 instances Efficiency is above 95%, minimum Efficiency is 90.1%. The present heuristic shows higher average Efficiency than that of the GT Method, in all instances, except 2, which are of smaller size relatively.

We may also mention that, the present heuristic, in fact, has obtained the same or almost the same solutions with N = m n (i.e., with about 1/1000 time), for all instances, except MT10. For this instance, average efficiency has improved by 3.3% (from 93.5% to 96.8%) with higher number of iterations.

Table 1: Performance of the Heuristic in some Benchmark Instances

S No	Instance Id	Instance Size	Optimal Makespan	Heuristic Average Efficiency (%)	GT Method Average Efficiency (%)	Heuristic Average Time (s)	GT Method Average Time (s)
1	LA1	5 × 10	666	100.0	97.6	20.2	32.8
2	LA2	5 × 10	655	91.1	91.2	22.2	33.0
3	LA7	5 × 15	890	100.0	96.1	57.0	100.2
4	MT20	5 × 20	1165	90.5	87.5	132.8	225.8
5	MT6	6 × 6	55	92.7	97.0	10.8	13.4
6	MT10	10 × 10	930	96.8	85.7	153.1	202.8
7	LA19	10 × 10	842	96.0	88.1	135.6	204.4
8	LA20	10 × 10	902	95.7	90.0	138.0	203.0
9	ABZ5	10 × 10	1234	97.3	91.6	134.1	204.1
10	ABZ6	10 × 10	943	96.4	90.0	128.1	204.4

4.2. Random Instances

First, we consider instances in which the jobs have different routes through the machines. In all the instances here and afterwards, all jobs are processed in every machine. The processing times and the sequences are generated randomly (independently). The processing times have uniform distribution in [1, 6). We consider instances as, 3 (machines) 6 (jobs), 3 10, 6 6, 6 10, 10 10, 10 15. In each case, 10 instances are solved. The solution quality, in terms of Efficiency, is verified with respect to the solution as given by a B & B method with the ILP1 formulation. We use LINGO 17.0 to solve the ILPs. It has been observed that, the B & B method does not end even after 2 hours, for many instances that we have attempted. Often, solution obtained within that time is not an optimal solution; or, even if an optimal solution is reached the method goes on (as has been observed with some benchmark and some other instances). Seemingly, a B & B method with the ILP formulation is effective and conclusive only if number of integer variables is within 150. As such, we impose a time limit of 30 minutes and compare the best solution that is obtained within such time limit. For every instance, the heuristic method is applied only once. We give average solution efficiency and average solution time (for the 10 instances in each case). These are given in Table 2. The performance of the method is satisfactory; for example, optimal solutions have been obtained in all the instances for 3 10 case.

Table 2: Performance of the Heuristic Method in Random Job shop Instances

S No	Instance Size	Average Efficiency (%)	Number of Matching (or, Better) Solutions	Average Time (s)	Remarks
1	3 × 6	99.6	9	2.2	B & B method obtained an optimal solution in all cases (often within 2 s)
2	3 × 10	100.0	10	6.4	All solutions same as of B & B method; B & B method did not end in 30 min in any instance
3	6 × 6	93.5	0	11.1	B & B method obtained an optimal solution in all cases (often within 2 s). Minimum Efficiency of the heuristic method 82.8%
4	6 × 10	98.2	4	32.1	B & B method did not end in 30 min in any instance
5	10 × 10	96.5	2	134.4	Heuristic solution better in one instance; B & B method did not end in 30 min in any instance
6	10 × 15	110.6	10	336.6	Heuristic solution better in all 10 instances; B & B method did not end in 30 min in any instance

Next, we have considered randomly generated flow shop instances. A heuristic method for the jobshop problem should also work well for the flow shop problem. We consider 3 8, 3 9, 3 10 flowshop instances. It is known that (e.g., Pinedo 2002), for the 3 machines case, with makespan as the objective, there exists a permutation schedule (i.e., every machine has the same sequence of the jobs) which is optimal. For such instances, we consider the performance compared to an optimal solution obtained with exhaustive enumeration of all permutation schedules. 10 instances in each case are examined. The results are given in Table 3(a). The heuristic method shows a notable performance with many optimal solutions. Least Efficiency observed has been 91.9%, and it has occurred for a 3 8 instance. We also consider flowshop instances as 4 10, 5 10, 6 10, with 10 instances in each case. Here, the solution quality is considered with the best permutation schedule obtained with exhaustive enumeration. For the 4 10 case,

for 5 instances, we have seen that B & B solutions, with 30 minutes time limit, give worse solutions than best permutation schedules, with average Efficiency of 97.3%. Hence, we only use best permutation schedule to calculate Efficiency. The empirical results are shown in Table 3(b). Present heuristic solutions compare quite favourably with best permutation schedules.

Table 3(a): Performance of the Heuristic Method in Random Flow shop Instances (3 Machines)

S No	Instance Size	Average Efficiency (%)	Number of Optimal Solutions	Average Time (s)
1	3 × 8	99.2	9	4.4
2	3 × 9	99.6	7	5.7
3	3 × 10	99.4	7	7.3

Table 3(b): Performance of the Heuristic Method in Random Flow shop Instances (> 3 Machines)

S No	Instance Size	Average Efficiency (%)	Number of Matching Solutions	Average Time (s)
1	4 × 10	98.7	4	13.9
2	5 × 10	97.5	2	24.0
3	6 × 10	97.6	0	37.9

5. Conclusion

We have given a heuristic method for the job shop problem with makespan as the objective. The method is based on an optimal result for a single machine sequencing problem. It is used as a priority rule. The priority rule is combined with a particular kind of random perturbations. The method shows satisfactory result in a numerical experiment with benchmark and random instances. The method has provable polynomial worst case computational time bound and memory requirement is less. Such observations indicate that, the method should be useful to obtain a satisfactory solution, of about 95% Efficiency, within relatively less time, for large instances, in practical contexts. It may get a solution with above 90% Efficiency, for most of the instances, very fast (with N = m n). The solutions, if necessary, may be attempted to be improved with genetic algorithms, etc. The method, being fast, is suitable for real time applications. Thus, the method may be considered as a possible alternative to solve the job shop problem.

The method also has some limitations as, there may be cycling and some schedules may repeat in the iterations. Apparently, this is not of much importance practically.

Some variants of the method are possible. The method may also be applied for job shop problems with other objectives. It may have some desirable theoretical properties, for some special cases of the problem, e.g., number of jobs is much larger than the number of machines and processing times have less dispersion. The method may also be suitable for the flow shop problem, with makespan objective. It will be highly valuable if the method is studied further and such points are investigated.

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Promoters Share Pledging: An Emerging Concern for Indian Stock Market Regulator

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Abstract

Pledging shares as collateral for borrowing is common for corporate entities. Till-date substantial academic research has been conducted on the various aspects of corporate borrowing. Several research studies in accounting and finance domain have been conducted on multiple issues relating to corporate borrowings. In disparity, minimal research has been done on the various dimensions of promoters/insider-owners borrowing using the firm's shares as collaterals (Asija, Marisetty, & Rangan). If the pledging of promoters shares is for short-term working capital requirement, it could not be considered as risk (Kumar, 2015). On the other hand if the corporate survives for longer duration on the funds raised through pledging of shares than it may be concern for market regulators. The present shares pledged by promotes of Indian companies is raising alarm among stakeholders. The promoters of Indian listed companies pledged more than INR 1.2 trillion worth of shares in FY 2018 – 19, 60 percent higher than FY 2017 – 18. The upper-level pledging of shares by promoters has put both borrowers and lenders at risk (Xavier, 2019). The ever increasing percentage of promoter shares being given as collateral has highlighted the risk involved. Pledging of firm's shares by promoters is one of the issues that is ever debated in the context of corporate governance. Insiders' share pledging for bank loans is a long-standing corporate governance issue (Wang & Chou, 2016). In this backdrop, the present paper provides an overview of promoter share pledging in Indian capital markets and the perceived implications of these pledged deals.

Keywords: Insider-owners, Promoters, Share Pledging, Collaterals, and Indian Capital markets.

1. Introduction

Promoters (owner-managers) are the major shareholders who generally manage the strategic operations of the listed entities. Promotes being in-charge of the strategic decisions have to manage 'Funds' for business operations. In case of scarcity of funds for business operations or investment (business acquisitions), the promoters raise funds by pledging the firm's shares as collateral. In a few cases, the pledge of shares may be for personal investment needs. Capital markets had also witnessed the promoters pledging of firm's shares to acquire and raise their shareholding in the same company (creeping acquisitions). In India, the current regulations allow both resident and non-resident promoters to pledge their shares. The trend of pledging of promoters holding varies across sectors. Promoter pledging of shares is higher in the case of infrastructure, engineering, and textiles sectors. Promoter's investment in new Greenfield projects by the pledging of shares could be seen more in the case of power and steel sectors (ET Markets, 2019).

Pledging of shares by promoters group is not an unusual aspect. Corporate finance theory states that pledging of shares by promoters for valid purposes could create value in the long-run with associated risks for investors in short-run. It is believed that shares of the listed firm with higher promoter pledging would experience high volatility in their security prices, which in turn may lead to substantial losses to the investors (especially retail investors). The reason for such fluctuations in security prices is the fluctuations in the value of the collateral and the need for pledging more shares or shell down cash to compensate the shortfall in the value of the collateral.

Three major category of lenders that accept shares of promotes as collateral are: a) banks, b) Non-Banking Financial Companies (NBFCs) and c) mutual funds with debt schemes. Banks prudential norms would not allow larger exposure of bank funds to specific sectors. In this scenario, NBFCs and mutual funds are the alternative source of borrowing for promoters by giving their shares as collateral. Vasudevan (2019) states that cash-flush mutual funds and non-banking finance companies (NBFCs) dominant lenders to promoter groups. Out of the three major categories of lenders viz. banks, mutual funds and NBFCs, the significant risk of lending is faced by the

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mutual funds. The risk faced by the mutual funds emerges from the fact that unit holders may seek redemption of units in a downward moving markets and the borrowers (promoters) could not meet the margin calls. In that kind of scenario the fund managers have left with no option to off-load the shares held as collateral to meet the margin requirements. This action could further worsen the situation. In recent past the Indian capital markets have experienced these situations. Considerable amount of volatility has been prevalent in case of few stock in the Dalal Street.

In the above stated backdrop, the present paper is aimed at providing an overview of the contemporary state of affairs concerning the pledge of promoter's shares and associated implications that raise concern for regulators.

2.0 Review of Literature

Under pledging of shares, promoters give their stake of shares as collateral for borrowed money. Lenders are generally commercial banks or non-banking financial institutions. Usually, the pledging of shares by promoters is discussed in light of corporate governance. Issue of promoters pledging the shares has been a long-standing problem concerning the implementation of good governance. Lawmakers contended that pledged shares for bank loans replicate the degree to which firm director's rise to leverage, explicitly in using less personal funds, to fight for control rights. Regulators are concerned with situations where the promoters pledge shares when stock prices are high and then engage in riskier operations for higher returns to boost security prices (which are given as collateral), and further magnify the volatility of the firm value. On the contrary, the severe situation may be when promoters who want the company to go down, do not repay the loans and exit. This leads to a fall in the stock prices, and minority shareholders would suffer (Wang Y. C., 2015).

In India, promoter share pledging came under regulatory study in January 2009 during the exposure of Satyam scandal. Before the Satyam scandal, firms and their promoters were not required to disclose the existence or magnitude of share pledges. SEBI has come out with disclosure requirement on January 28th, 2009, that mandated promoters and companies to disclose details of share pledging (Asija, Marisetty, & Rangan). The disclosures made during 2009 revealed that, but for a minority of high-profile conglomerates, practically every promoter of India's top companies has admitted to pledging shares for several years now. The predominant end-use of the funds raised was either to increase the promoters' stakes in their respective companies or to give supplementary guarantees to financiers (especially banks) for loans taken (Verma, 2009).

Pledging of shares by promoters is legal and accepted as long as it serves the interests of all the stakeholders in the firm. In many cases, promoters go overboard and pledge the shares without fully considering the consequences, and Satyam episode is a classic case study. Bhasin (2013) in his article, mentions that the letter from Mr. Raju to his Board of Directors (BoD) clearly states the kind of fraud that was committed by giving promoters shares as collateral. The said letter indicated that the debacle of Satyam started only after the lenders started off-loading most of the shares held as collateral on account failure to meet the margin triggers.

Satyam corporate fraud has made the regulators monitor the risk involved in promoter's stake being used as collateral. Usually, banks are the conventional lenders for the promoters on the pledged shares. In this regard, the banking regulator Reserve Bank of India (RBI) expressed concerns over promoter's shares being accepted as collateral. The Financial Stability Report (2013) expressed certain apprehensions over pledging of shares by promoters. Because of the prevalence of promoters pledging a considerable portion of their shares, the subsequent leverage could be a concern not only for shareholders but also for the well-being of the financial system. When promoter's shares are given as collateral, the promoters have no personal liability other than to the extent of their pledged shares. In some instances, the shares pledged by unscrupulous promoters could go down in value, and the promoters may not mind losing control of the company as there is a possibility of diversion of funds before the share prices collapse (Reserve Bank of India, December, 2014).

The asset quality of banks is stressed due to the ever-increasing pledging of shares by promoters. The stress in corporate debt is also confirmed by data on the stocks pledged by promoters. The percentage of shares pledged by promoters out of their holdings in all listed companies across NSE and BSE has shown a steadily increasing trend over the years. Among all NSE listed companies (including companies with no pledging), the percentage of

promoter held shares pledged went up from 15.2 percent in March to 15.3 percent in June 2016. The corresponding numbers were 13.8 per cent in December 2013, 14.4 percent in December 2014, and 14.8 percent in December 2015 (Reserve Bank of India, December, 2016).

The promoter pledges data of 2019 is further interesting and provides lot of insights. Kant (2019) in his news article, quotes that the promoters have raised the number of shares pledged with their lenders as collateral for borrowing by 23 percent on a year-on-year (YoY) basis. At the end of the December 2018 quarter, promoters of BSE 500 companies had pledged 15.7 billion equity shares, against around 12.8 billion equity shares at the end of the December 2017 quarter. In rupee terms, promoter-owned shares worth nearly Rs 2 trillion were pledged at the end of the December 2018 quarter, up 2.6 percent on a YOY basis.

In the recent past, the concerns of the banking regulator RBI came turn concerning volatility in Indian stock-markets. During 2019 two significant incidents of market capitalization erosion relating to Reliance Group and Essel Group has once again raised regulatory concerns on promoters pledging shares. Loss in market capitalization has created substantial losses to the shareholders and has hampered the interests of other shareholders too. Pledging of shares by promoters is increasingly becoming a significant corporate governance issue. In India, there are many companies where promoters have pledged a substantial percentage of their shares. Both RBI and SEBI, are putting efforts to design a suitable policy to avert possible crises shortly (National Stock Exchange, February, 2019).

Shares being offered as collateral by promoters has its benefits from the perspective of owner-managers. For example, even after pledging the shares the promoters could exercise voting rights. However, the pledging of shares could be used by promoters with fraudulent intentions such as pledging the shares when the assets of the overvalued. By pledging the shares, the promoters could be transferring the risk to the lenders. Promoters share pledges involve many corporate governance issues.

By reviewing the existing body of knowledge, it could be stated that the research in the area of pledging of shares by promoters and related implications is minimal. Focused academic and industry-sponsored studies are required in this direction.

3.0 Aim and Methodology:

The primary aim of this paper is to bring into focus the risks involved in high degree of promoter shares being offered as collaterals. The paper is descriptive in nature and is expected to suit the objective of the paper.

4.0 Discussion

Promoters pledging of shares even though legal, has its share of risk involved. Generally, if promoters of debt-burdened listed entities also go in for creating equity-backed bonds than the risk would increase. On January 27, 2006, Securities and Exchange Commission (SEC) published a document recognizing that the share pledges of the CEO of WorldCom may have led to the fall of the company and solicited public feedback on regulating share pledges by insiders. The report stated that share pledges might influence the incentives of insiders and, in turn, their ability to make optimal decisions (Singh, 2018).

Insider/promoters pleading can influence the value of the firm through several channels. First, regardless of how insiders use the proceeds of loan procured using shares a collateral, pledging of promoters stake increases a company's exposure to adverse price movements. Since pledging signifies a margin loan secured by company stock, substantial price declines in the stock automatically trigger margin calls. Servicing these margin calls can be tough for an insider since the preliminary motive for pledging is generally inferior liquidity. In case of no proper response to margin calls, the lenders would sell off the stock which compounds the downward pressure on the stock price. This whole process leads to expansion of the left-tail of the stock's return distribution, thereby exposing the shareholders to credit risk (Dou, Masulis, & Zein, 2019).

On the face of it, the equity-backed bonds instruments look like a win-win situation for both the borrower and the lender. Initially, the bonds are issued with a more significant equity-based collateral than the money borrowed and the margin calls on the instrument could be structured with a broader trigger level. This structuring

could be beneficial for both the parties because an average fall in the value of the collateral would not trigger any top-up. On the other hand, if a sharp decline in the market value of the collateral and promotes non-ability to top-up the margins, the lenders would be forced to off-load the shares. This action by lenders would further erode the market value of the shares.

As the financial markets are highly interconnected, the negative impact in one segment of the market could spill over to the other sections and lead to massive wealth erosion. The point in discussion could be associated with the latest happening in the Indian stock markets. Relevant cases for discussion are Essel Group and Reliance ADAG. The recent instances have clearly emphasized the risk that is tagged with equity-backed bonds issued by promoter groups in India. The risk involved in equity-backed bonds is different from the loans granted by banks on shares as collateral (Palepu, 2019).

Promoters share pledging being very much on rising in the Indian capital markets has made the market regulators to re-assess the risks involved. In India and Taiwan, more than 20% of insiders pledged a significant portion of their shareholding. Recently, share pledges have caught the attention of regulators and participants worldwide. Regulators in India, Singapore, U.S., and the U.K. start to mandate strict guidelines with promotes share pledges. It is also reported that 49% of the institutional investors have considered that the pledging of shares by insiders is problematic. However, the consequences of increased share pledge by insiders/promotes is not yet understood fully (Chan, Chen, Hu, & Liu, 2015).

The recent incidents in stock markets of a few of the emerging economies have put the market regulators on high alert. Not only the market regulators, but the financial analysts are also cautious of picking stocks of those companies where the insider/promoter share pledging is increasing. In general, terms, if the promoters shares pledges cross 75% threshold over a period, it is considered as 'risky' investment. Regulators and investors are not only concerned with the companies that have colossal promoter share pledges but also worried about mutual funds schemes which have lent money to promoters based on equity-backed bonds. In extreme cases, when the market prices of the pledged stocks fall and the mutual funds lack the liquidity to service the unit-holder's redemption demands that the situation deteriorates.

At the initial stage, the market regulators are trying to bring in stringent timely reporting norms. Quarterly disclosures concerning promoters share pledges are considered to be not adequate. The time lag between the pledges and consequent disclosures is expected to be narrowed down. Apart from the revelations, the valuation and credit rating of equity-backed bond instruments are to be made stringent. Finally, it would be apt if collective investment schemes such as mutual funds are restricted from investing in these kind pledge instruments.

5.0 Conclusion

The paper focused on a topic which looks very simple on the face of it but has a lot of implications for both retail and institutional investors. The paper aimed to bring out the conceptual framework and risks involved in share pledges by insiders (especially promoters). In the present day scenario, the article gains currency by the fact that high degree of promoters shares being offered as collateral and the consequent fall in market prices would lead to fatal consequences. Market regulators and players such as SEBI, SEC, proxy advisors, business media, and investment consultants are very concerned about this issue (Hwang, Qiao, & Ku, 2016). The recent incidents in Indian stock market that led to debates among mutual funds and NBFC industry leaders was an inspiration to this paper. The topic requires further deliberation and focused research using empirical data. The overall summary of the discussion is as follows:

Promoters or any other insider group are allowed to give their shares as collateral to procure loans. Pledging of shares by insiders would be done because it has advantages like generating liquidity without losing control of the firm. Pledging allows getting a low-cost loan on undervalued securities whose prices would escalate in the future. This practice is accepted all over the world. While this practice helps in overcoming the liquidity constraints faced by companies and promoters, the method may lead to adverse consequences if not monitored and controlled by the market regulators (Larcker & Tayan, 2010).

In the recent past, the institutional investors who have invested in companies with high insider/promoter pledged shares had expressed concerns. Many of the proxy advisory firms have started to vote against the companies which have a considerable magnitude of aggregate pledged shares in terms of total common stock or market value or trading volume. However, the threshold above which the pledged shares will lead to dissatisfaction among the stakeholders is not yet specified. The appropriate threshold of promoters share pledges could be decided based on further research.

Along with stringent disclosure guidelines, the market regulators are expected to come out with clear instructions on aspects like a) What should be the threshold for insider/promoter share pledges, b) What circumstances could be considered as appropriate for pledging of shares, c) Valuation issues, d) Prudential norms for lenders such as mutual funds and NBFCs for lending on equity-backed bonds and finally e) Mechanism to disclose the risks involved in share pledges by insiders. These kind of guidelines are expected to protect the interest of the shareholders.

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Effective Strategic Talent Acquisition Process - A Conceptual Study

R. Anita*

Abstract

Recruiting and Talent acquisition are undergoing a rapid disruption and challenging the companies to attract the right talented individuals or re-recruit the employees every day. Organisation success largely depends on having right people on the right job so that formulated business strategy can be implemented. Hence, the organisations that implement the talent acquisition strategy which are effective are the ones that are successful while the companies that have bad hires will result in reducing of profits. There is a great transformation from just recruitment to talent acquisition. Companies are embracing new technology advances like Artificial Intelligence, big data analytics and others technologies to reduce the time of sourcing candidates and recruit skilled and talented candidates. This paper uses secondary data from various surveys retrieved from web sources. The study aims to understand the challenges and new trends of talent acquisition, experts' opinion on future talent acquisition process and suggests effective strategic talent acquisition process.

Keywords: Talent acquisition, trends of Talent acquisition, Challenges

I. Introduction

Recruitment is generally used in synonymously with Talent acquisition but it is only a part rather subset of talent acquisition. The basic difference between Talent acquisition and recruitment is the focus. Recruitment focuses on the present requirement of the company and does not check the person-job fit and only helps in getting the interested people for the jobs that are available. Whereas Talent acquisition is a strategic approach and helps to find the best person for the job available. It means it includes from the future skills requirement to the organisational cultural fit. Hence, talent need to be acquired rather than recruited from long term or strategic point of view.

Talent Acquisition is the strategic method of identifying, attracting and selecting the best available skilled person and ensures that right person with the right skills, knowledge and aptitude is employed on the right job to meet the dynamic demands of the every changing business needs. Talent acquisition includes workforce planning, sourcing decisions, employment branding, candidates relationship management and usage of metrics and analytics to continuously monitor and tracking of the candidates performance.

According to Flegley (2006), competition for attracting and retaining the talented personnel and lack of available high skilled and talented employees has become a major priority for organizations.

As we all know that employees are the biggest asset of any company, hence one need to focus the kind of people to be attracted and recruited. The truth is people make the difference and when we do not have the right individual in right place the efficiency can dip. Hence, to gain competitive advantage people need to be motivated and be placed in right job as per their abilities. If the employees are not motivated they may fall sick frequently and may harm the ability to be competitive. A recruiter or employer in the present competitive world can add value to the organisation by building psychological bond and emotional connectivity with the employees and continuously building and strengthening the employment brand.

Present organisation are now having attracting the right and quality talent as one of the main recruitment goal to gain more competitive advantage. Effective talent acquisition is very important and crucial for any success of business as it saves time and cost. According to SHRM (2016) an effective talent acquisition strategy consists of six elements: employer branding, workforce planning, Sourcing and recruiting the right candidate, leverage of recruiting technology, an effective on-boarding programme and application of data analytics.

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Proper effective workforce planning need to be done and spans from attracting to retiring and includes talent attraction, acquisition, development and retention. Strategic planning of workforce includes the analyzes of both internal and external supply of workforce in the organisation, understand and review the future business plans and objectives, identify the gaps after analysing between supply and demand and address the gaps as per the requirement and need. According to study done by talent management insights group Corporate Executive Board (CEB), it was found that performance of key objectives on an average declined by 34%, when the top leadership position was filled with external candidates and it always showed that 21% of the companies are more likely to fail of external candidates are given the senior leadership position.

This article on Talent acquisition is explored further with the following objectives:

1. To study various challenges faced while acquiring talent
2. To study the latest trends of talent acquisition
3. To suggest steps for effective strategic talent acquisition

Secondary data is collected from various web sources for the study.

II. Review of Literature

Pallavi Srivastava & Jyotsna Bhatnagar (2010) is their article addressed various concerns related to acquisition of the talent and suggested that employer branding can overcome some of the concerns. They also explored and developed a scale to measure employer brand.

Senthil kumar (2016) in his study analysed the responses from 750 IT sector Employees in Bengaluru district and found that employees were highly attracted and top performers were related because of good talent management practices like educational benefits, good salary package and Job security.

Tom Baum (2008) in his paper explored the precise features of hospitality and tourism sector labour markets in developed countries and analysed the scenarios of talent management within which the businesses can operate. It was concluded that an inclusive and developmental approach, wherein talent identification and acknowledgement was focused was the most effective approach within this sector.

Stephen A. Stumpf (2010) discussed in the case study that while contributing to the organisation goals, organisation's leaders were not able to meet their personal goals. The researcher mentioned that in order to attract, develop and retain the talented top level people quality talent management programme was implemented. The researcher also mentioned that for sustainable success in the global market place specially related to success with customers, employees and investors top talent is required.

Bhati, Abhishek & J Manimala, Mathew (2011) in the article discussed innovative HR strategies like brand building, attracting employees to serene lifestyle, jobs in line with vision and value, providing attractive fringe benefits to the employees, creating a sense of ownership among employees, creating entrepreneurial opportunities within the organisation, providing opportunities for personal growth, exploring employees from among beneficiaries can be adopted to attract and retain talent by social enterprises.

Srivastava, Pallavi & Bhatnagar Jyotsn (2008) in their paper discussed due diligence to be practiced in the talent acquisition strategy using the case study on Motorola India- Mobile Devices Business. The paper explored the relationship of talent acquisition and levels of employee engagement. After assessing the person-organization fit,, they suggested that the organisation should make efforts to build practical, effective and holistic talent acquisition strategies to attract and retain talent with key skills. The paper also mentioned that employee engagement needs to be addressed to enhance the business performance and productivity.

Saraswathy R & Balakrishnan Janarthanan (2017) in their paper surveyed 410 employees of various designations in Information Technology industries and found that employer branding efforts helps to attract and retain talent and heightens employee engagement.

Tyagi Rajiv & Parimoo Daleep (2017) in their paper discussed that HR strategies like long term career goals, opportunities for personal growth, brand building, creating a sense of ownership among employees, well-defined career growth, mapping vision and value analogy to individual capabilities etc. can be adopted to attract and retain talent in solar companies.

According to the study on trends of recruitment statistics 2018, shortage of talent is the one of the main hurdle faced by the recruiters in 2018. The study revealed that 42% of employers felt that they will not be able to find the right talent needed and 72.8% of employers opined that it is difficult to find required people.

III. Latest Recruitment Trends

As per the white paper published by CV Library, the top recruitment priorities in 2018 are the following:

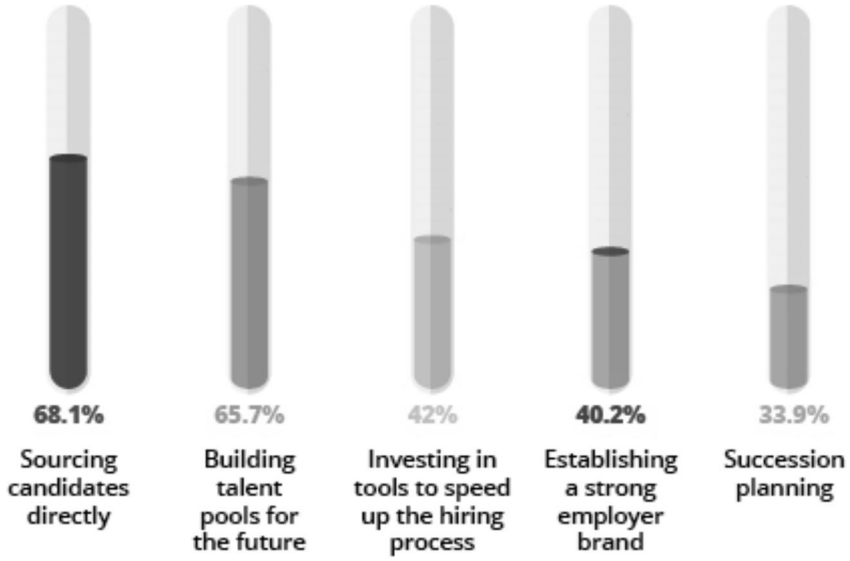

Chart 3.1: Top recruitment priorities of the organisation in 2018 (Source: https://www.cv-library.co.uk/recruitment-insight/2018-store-recruitment-whitepaper/)

From the above chart 3.1, it can be observed that 68.1% are sourcing candidates directly through external sources and 65.7% are building talent pools for the future and using them as and when needed as per their requirement.

According to survey by talent now, recruitment statistics 2018 trends show that majority of the companies are sourcing the candidates from job boards followed by linkedln, own career website, employee referral schemes and job/candidate aggregators.

Chart 3.3: The top reasons for considering diversity in the present organisation Source:Secondary data from https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/

From the survey report of linkedIn Global Recruiting Trends 2018 it was observed that diversity, data analytics, adopting new interviewing tools and processes and use of Artificial Intelligence were the top and latest trends.

1. **Diversity:** Diversity means giving all equal opportunities irrespective of gender and ethnicity including candidates with disabilities and veterans.

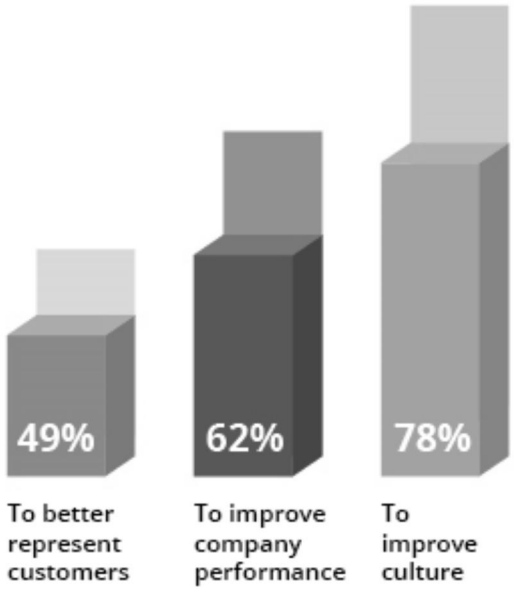

Chart 3.3: The top reasons for considering diversity in the present organisation Source:Secondary data from https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/

From the above chart 3.3, it can be observed that organisations are going for diversity programme to improve their culture and company performance.

According to Glasdoor 14.2 % of women hold leadership roles in S & P 500 companies and 4% black hold CEOs position in the fortune 500 companies.

2. **New interviewing tools and processes:** Organisations are adopting new interviewing tools and processes to assess overall skills and capabilities of a candidate in much lesser time.

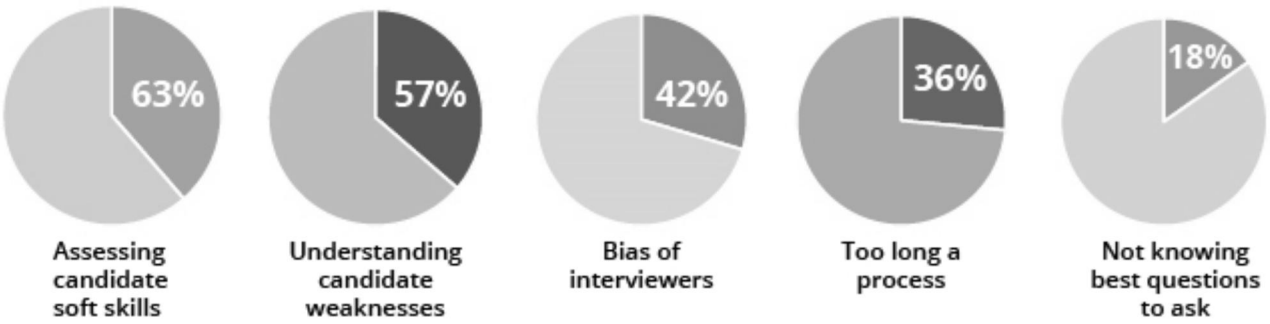

Chart 3.4: Where traditional interviews fail, Source: https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/

From the above chart 3.4, it can be observed that 63% of the organisations are not able to assess candidate soft skills through traditional interviews hence the organisations are using new interviewing tools like mainly like soft skills assessments, meeting in casual setting and job auditions..(Refer chart 3.5)

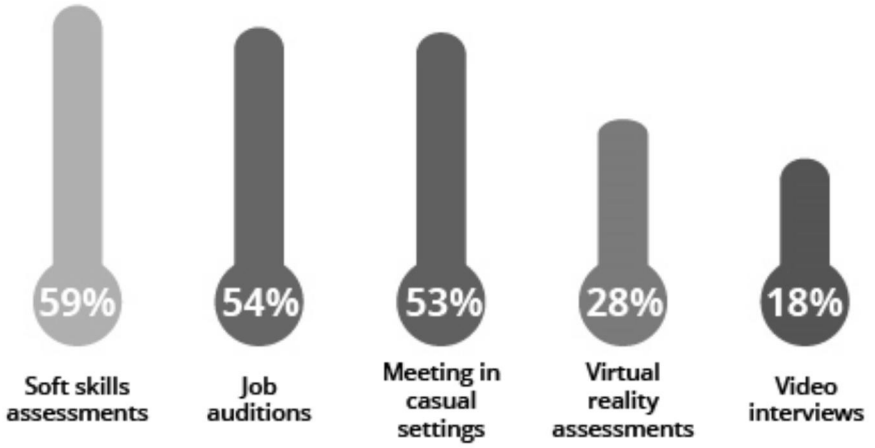

Chart 3.5: Most useful interviewing innovations. Source: https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/.

3. **Use of data to make strategic hiring decisions:** The top uses of data in acquiring new talent is presented below

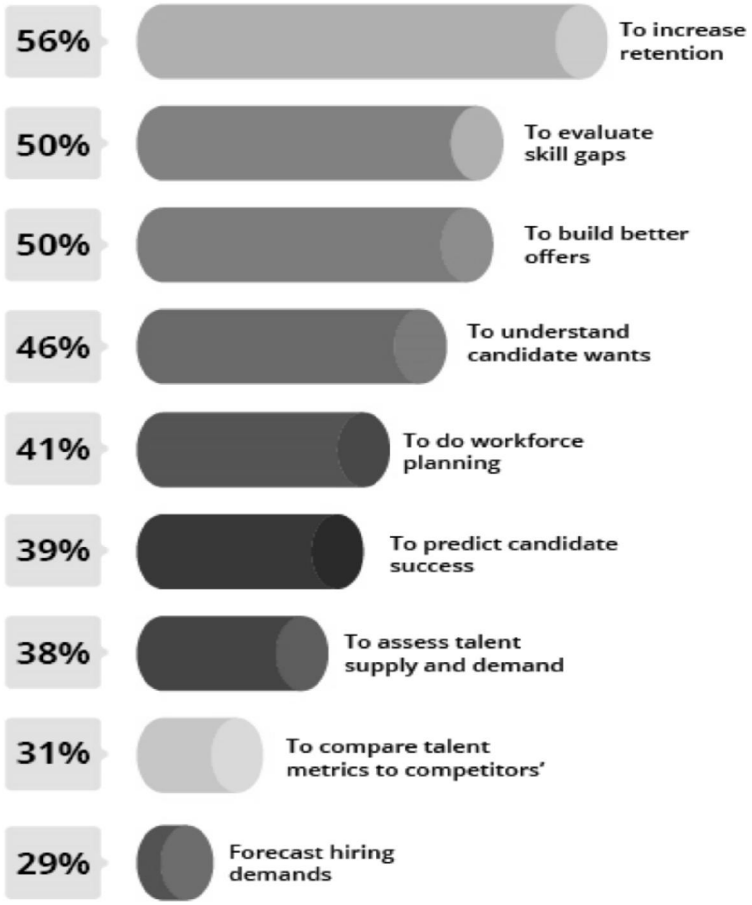

Chart 3.6 Usage of data for strategic hiring. Source: https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/

From the chart 3.6 it can be inferred that 56% of the companies are using the data to increase retention and 50% of them are using to evaluate the skills gaps and build better offers. Companies are also using the data to understand what the candidates wants, plan workforce, predict candidates' success, assess demand and supply of the talent, compare metrics of talent with competitors and forecast hiring demands.

Today majority of the recruiters are not having the ability to effectively use data to make better decisions related to recruitment and improve the recuritment processes though they are well aware of using recruitment technology tools. Only 7% of HR professionals who have people analytics capability are optimizing their usage of analytics. (Source: CIPD)

4. **Difficulty in balancing the speed of hiring with quality of hires:** It was found that hiring managers and HR leaders on an average would rehire only 61% of their recent hires. Recruiters and hiring managers were unable to identify the right skill sets in the prospective candidates and the best channels to source the right talent because of the lack of understanding as well as communication between them. 80% recruiters think that they have very high understanding on the jobs and 51% recruiters opined that hiring managers need to communicate clearly what they are looking in the candidate. On contrary 61% of Hiring managers opined that recruiters have only a low to moderate understanding of the jobs and 77% of hiring managers feel that recruiters do not use proper screening techniques or tools for screening the candidates.

5. **Usage of artificial intelligence (AI) and automation** for better recruitment and making the hiring process more error free.

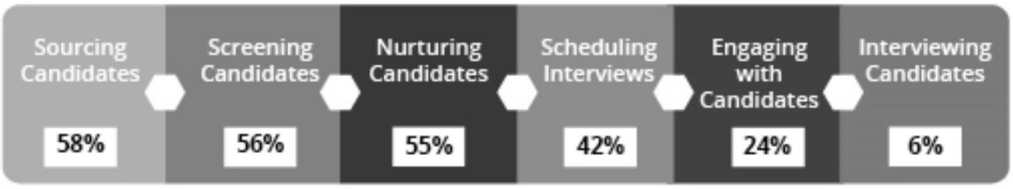

Chart 3.7: Usage of AI in the year 2018. Source: https://www.talentnow.com/recruitment-statistics-2018-trends-insights-hiring-talented-candidates/

From the above chart 3.7, it can be observed that 58% of the companies are using AI for sourcing candidates, 56% of them for screening candidates, 55% for nurturing candidates, 42% of them for scheduling interviews and few of the companies are using for engaging with candidates and interviewing candidates. AI will be used to create chatbots to automate the initial communication and candidates' screening. 62% of companies are expected to use AI by 2019 (Source: Haptick, Linkdlen)

80% of employers opined that passive candidates can be found using social recruiting, 70% of hiring managers opined that social media is used for successful hiring and 89% of companies plan to use social media to recruit candidates.

IV. Current Recruitment Challenges Faced by the Recruiters

According to the talent now survey 2018 the challenges faced by the recruiters are:

1. Most of the recruiters and employers feel that the labor market is candidate- driven and top candidates stay available for 10 days only before getting hired.

2. Most of the job seekers opined that reputation of a company is important than the pay increase. It was found that 55% of the job seekers do not apply after reading online reviews.

3. Attracting top quality candidates in dynamic market has become difficult because talented job seekers are having multiple offers in hand.

4. Lack of efficient recruitment process and lack of understanding the changing needs and desired of the candidates
5. Delay in the candidates hiring process
6. No proper candidate tracking systems by recruiters
7. Screening talented employees from the large pool of candidates
8. Failure to provide good experience to the candidate during the hiring process

V. Experts Views on Future Talent Acquisition Process

The following are the experts' views from various fields:

- Machine learning and artificial intelligence will continue to grow and assist the recruiters to pick the skilled and talented candidates faster than before.
- Recruiters need to People analytics tools to make best hiring decisions
- Recruiter will be using organisation network analysis to understand the workflow patterns, roles and more by capturing data from emails, other sources and feedback activities.
- Automate tools are also used for assisting and support hiring decisions but do not replace the humans.
- Recruiters need to re-skill themselves on the data analytics, big data processing, machine learning management and artificial intelligence.
- Video assessment of the candidates will be preferred to source candidates globally as it is six times faster than traditional telephone interviews. Recruiter will be using it to evaluate soft skills and assess whether the candidate is a best fit into the culture of the organisation.
- More companies will be reframing their HR policies including wellness programmes, HR technology tools and platforms for self assessment, end-to-end healthcare solutions and coaching.
- Usage of more global sourcing and remote working will continue to rise.

VI. Suggested Steps for Effective Strategic Talent Acquisition Strategy

1. Understanding the organisation vision: Organisation vision should be clear to know what the organisation wants to achieve in long run.
2. Formulating the HR strategy/Talent Acquisition Strategy in line with vision
    - Identifying global sourcing strategies through social media
    - Use talent relationship management techniques (According to Mercer research agency 79% of organisations are building and encouraging their own talent from within)
    - To Use mobile – enable application process (According to Pew Research 94% of job seekers use smart phones to browse/ research on job vacancies)
    - Using Artificial Intelligence Technology
    - Using employee referral system effectively
    - Use of temporary workers as per the need
    - Balancing both client and candidate experience
    - Reducing time-to-hire

3. Implementing the HR strategy : The talent acquisition strategy process need to be implemented as per the requirement of the company

4. Follow up/Expediting the process: The process need to be expedited to understand whether is progressing as per the plan decided

5. Checking the process: The talent acquisition strategy need to be checked if any deviations are there as per the standard plan established.

6. Evaluating and corrective action: Any deviations, the organisation need to find out the root cause and take correction action according to the need.

VII. Discussion and Conclusion

From the survey and above data analysis result show that most of the companies are sourcing candidates from job boards, linkedln and employee referral schemes. Diversity programmes need to be effective for improving the organisation performance. New interviewing tools like assessment of soft skills assessments, meeting in casual setting and job auditions can be explored and used. There should be proper usage of data to attract talented candidate and retain top performers. HR professionals need to be trained in people analytics to optimally utilise the usage of analytics. Good Understanding and effective communication between recruiters and hiring managers should be there to source the right talent and identify the right skill sets in the prospective candidates. Companies need to be encouraged to use the Artificial Intelligence and Machine learning in hiring process but the areas like building relationship, checking candidates' potential beyond credentials, gauging interpersonal skills in candidates and convincing the selected candidates to accept offers still require manual interventions. Hence, effective Talent acquisition strategy needs to be implemented to acquire best person – job fit, save time and cost.

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The Motivational Preferences of Gen Y: An empirical Study on Recent Changes in Motivation of Gen Y

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Abstract

Managing young talent is becoming an area of growing concern in the literature. The purpose of this paper is to investigate motivational preferences of Gen Y through a study conducted for Gen Y employees to know their preference for factors given by Herzberg's Two Factor theory. Generation Y have specific traits, needs and expectations and then it is vital that organizations understand these when looking to attract and retain to them. The paper deals with defining who Generation Y are – how they behave, what motivates them in organizations and attempts to identify the unique features of Gen Y employees and how their preferences have changed over time. The paper is based on an extensive study of Journals, Research papers, Articles, books, online information and a primary study conducted for Gen Y employees in companies. It concludes that there is not much extra effort required towards this but with just innovative thinking and understanding the nature of Gen Y employees, their performance at work can be drastically improved. This will be a guiding principle for companies to manage their motivation for better results at workplace. Research is original in contribution and adds value to the existing literature and corporate practices

Keywords: Gen Y, Motivation, Generations, Herzberg theory, Motivational Factors

1. Introduction

What is a "generation"? Strauss and Howe (1991) define a generation to be a cohort group whose length approximates the span of a phase of life and whose boundaries are fixed by peer personality. Peer personality is defined as a generational persona recognized and determined by common age location. Thus, it is the combination of being in an age cohort and sharing behavior and beliefs that define a generation.

Mannheim (1952) and later scholars defined a generation as a group of people "who share a common habitus, nexus and culture, a collective memory that serves to integrate" (Everman and Turner, 1998). There are two important elements to the term "generation"—a common location in historical time and a "distinct consciousness of that historical position, shaped by the events and experiences of that time" (Gilleard, 2004). A generation is popularly defined as "an identifiable group that shares birth years, age, location and significant life events at critical developmental stages" (Kupperschmidt, 2000); this definition draws on the notion of a common location in time.

There is little empirical and qualitative research on generations and most of the rigorous research has been conducted by sociologists and historians. There is therefore a strong need to further study the differences in rewards, development and training needs, leadership styles, and motivation of different generations (Paine, 2006), as well as across other diverse groups of employees. People are the most valuable assets of any organization and managing that asset is priority of any organization for the competitive advantage. Employees who are called Gen Y or Millennials will make up 50% of the available talent pool by 2020. It is important for every organization to have the right knowledge and practices to attract, develop and retain the best from this generation (Kim and Yang, 2013).

Millennials bring rich talent, enthusiasm, innovative ideas and diversity at workplace. They are conversant and comfortable with technology. But workplaces are not ready to match well with their preferences and styles (Erickson, 2008).

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In the coming years, this Gen Y workforce is going to be increase day by day in companies. Working with them is different from working with earlier generations. Talent management (TM) is becoming critical factor for the success of any organization specially with this tightened labor market. The best and brightest talent is needed to achieve higher than average. Special attention is needed for employee engagement for Gen Y to develop next-generation leaders (Phillip and Addicks, 2010).

Employers now need to embrace this change and implement new approaches to manage which are specifically tailored to Generation Y. The average tenure of a millennial is 2 years - adopt techniques that retain young talent for longer (Saxena and Jain, 2012). The requirement for interactive stimulation through online engagement is essential as the war for talent is becoming tougher. Some employers say no to Gen Y, while others are enjoying the challenges of the latest generation of workers. Companies are on the extremes of denial versus acceptance, excitement versus dread, opportunity versus threat. But it is generally agreed that it is this generation that will transform the way business is carried out for many generations in future.

Gen Y people are found to be complex, technology savvy but highly creative. They expect instant results but also claim development for the long term (Jindal, P. and Shaikh, M. (2017). They are environmentally conscious yet highly mobile. They like freedom at work but tend to value relationships over money. This mystery is challenging for employers, but organizations cannot overlook them just because it is difficult to manage them. Fortune magazine claims that they are destined to be the most high-performing generation in history. We need to find out the key to unlock their potential and develop them to be great managers and leaders of the future. Gen Y's are looking for a more personal relationship between employee and employer. When companies address Gen Y and compare them with older generations, they may find differences in economic, cultural and demographic characteristics. “This is going to be the most high-maintenance workforce in history - but I think they're also going to be the most high-performing workforce in history” (Tulgan, 2000). Some of the above-identified characteristics have an impact on the TM strategies of Gen Y people. Many authors are of the opinion that there is a clear link between the traits and characteristics of Gen Y people and the strategies to be adopted for their TM by the companies.

Herzberg's theory of motivators and hygiene factors: Herzberg (1959) constructed a theory of two-dimensional factors affecting people's behaviour towards job or work. He clinched that such factors as supervision, interpersonal relations, company policy, working conditions, and salary are just hygiene factors rather than motivators. That means the presence of these factor at work will not motivate employees. Rather, the absence of hygiene factors creates job dissatisfaction.

In contrast, he resolute from the research results that the motivators were elements that augmented a person's job. He also originated the five factors that were robust determiners of job satisfaction. Those are achievement, the work itself, recognition, advancement and responsibility. These factors (motivators) were associated with long-term positive effects in job performance while the hygiene factors dependably formed only short-term changes in job attitudes and performance, which swiftly fell back to its earlier level.

We can say that satisfiers describe a person's relationship with what she or he does, mainly related to the tasks being done. On the other hands, Dissatisfiers have to do with a person's relationship to the environment in which she or he completes the job. The dissatisfiers relate to the situation in which the person does what he or she does and satisfiers relate to what a person does.

With this background, this study aims to identify the unique traits and characteristics of Gen Y people and develop strategies to be adopted by the organizations to motivate and manage them and to bring out their potential to the maximum. This research brings out the preferential choices of Gen Y through a primary survey conducted by taking inputs from Herzberg's two factor theory.

2. Literature Review

Review of literature is done broadly covering the following aspects. The first section will define the generations, next section focuses on defining Gen Y employees, their traits, features, expectations and characteristics with reference to employment.

The further section will focus on the motivational preferences of Gen Y based on the Herzberg theory of motivation and comparison with the Gen X motivational preferences.

A generation is a group of similar aged people who live, and practice shared historic happenings, and their life history is of same period of time (Ryder, 1965). Further generations are defined as expected groups that share birth years, locations, age and substantial occasions at critical development stage (Kupperschmidt, 2000). There are two groups of scholars who define generations on two different views when the definitions are concerned with their workplace preferences. One group defines generation on the basis of shared age and time period of events, and these similarities influence their preferences, and every generation differ from each other (Zemk et al., 2000). Whereas the other group of scholars define that they might be from different time periods, but certain things are generic in terms of what they want from their jobs.

Currently, three generations are present at any workplace; Baby Boomers, Gen X and Gen Y. Baby Boomers are the people who are born between 1946 and 1964 as defined by the US Census Bureau. The Baby Boom generation has also been referred to as the 'pig in the python' (Callanan and Greenhaus, 2008). This generation is referred to as the Baby Boomers because of the extra seventeen million babies born during that period relative to previous census figures (O'Bannon, 2001).

The Gen Xers are born between 1968 and 1979 as defined by the U.S. Census Bureau. Though, the upper limit of Generation X in some cases has been as high as 1982, while the lower limit has been as low as 1963.

The Gen Y people, the generation of this study are born between 1978 and 2002. Generation Y may include folks born between 1980 and 1999 (Tolbize, 2008); 1978 and 1995 (The National Oceanographic and Atmospheric Association Office of Diversity, 2006); 1980 and 2002 (Kersten, 2002); and 1978 and 1988 (Martin, 2005). The tags associated with this generation are Millennials, Nexters, Generation www, the Digital generation, Generation E, Echo Boomers, N-Gens and the Net Generation, etc. All the three generations at work place are defined as per the years they born in. The information is shown in the Table 1.

Table 1: Three generations

The three generations at workplace	
Baby boomers	1943/46–1960/65
Gen X	1963/68–1979/82
Gen Y	1978/80–1999/2002

(Jindal, P. and Shaikh, M. (2017)

Gen Y: who is Gen Y?

The burgeoning generation is coming of age and arriving in the workplace with new ideas about the employment experience. These are called as Gen Y, Echo-Boomers, Millennials, etc. The Gen Y employees keep asking, 'why should I work for you?' and 'what are you going to offer me?' questions continuously.

They are found to be self-assured, tech-savvy and idealistic; they arrive at work with an evolved set of expectations for employment and their opportunity to have an impact from day one. The achievement orientation and natural impatience of this plugged-in, multi-tasking generation inevitably creates conflict for many employers and coincides with a time where the pool of skilled talent is shrinking. It is projected that there is going to be a shortage of talent at least by four to ten million by 2010 (Lisa B. Marshall).

This generation grew up with many latest electronic gadgets such as keyboards, cell phones, gaming pads, tabs, remote toys, most advanced TVs, automobiles, etc. (Sean Silverthorne, 2004). The author called them as 'gamer generation'. He opines that this gamer generation will make a very different kind of employees and managers.

Beck and Wade (2004) say that the gamers will make great workers and great employees. They know how to work in

teams, are creative problem solvers and believe that nothing is impossible. But managers need to know what makes this new generation tick in order to manage them effectively. A study by Ernst and Young, from more than 1,200 professionals across generations and industries about the strengths and weaknesses of workers from different generations, based on the perceptions of their peers indicates that 70–80% people think that Gen Yers are more social media opportunists and tech savvy.

The members of Gen Y are found to be ambitious, demanding, questioning, non-loyal and give more importance to their families, friends, communities and co-workers and finally to themselves. They are found to be gym lovers, tattoo lovers, stylish and not rebellious, use iPods, BlackBerrys, most sophisticated mobiles and laptops which are like their extra limbs (Pew Research Center). A research done by EY presents that younger managers rise fast in terms of career ladders. One reason for that can be that the Gen Y employees are very comfortable with the use of technology and social media. The new trend of Gen Y can be understood by the fact that organizations like Ernst and Young give flash drives in the place of brochures, use SMS facility to schedule meetings, provide video cameras to develop vlogs for its website. It also launched an official web page on Facebook to recruit Gen Yers. A changing economy has transformed the face of TM. Employers now need to embrace this change and implement new approaches to TM which are specifically tailored to Generation Y graduates. The requirement for interactive stimulation through online engagement is essential as the war for talent is becoming tougher and a powerful graduate program will become more vital than ever to ensure business success. Tulgan (2006), founder of Rainmaker Thinking and co-author of Managing Generation Y, is of the opinion that they are loyal, seek fair compensation and benefits, they sync well with modern day's economy. They do not hesitate to shift the organization the moment they realize the benefits are not matching the work levels.

Jones (2009) provided a list of expectations of Gen Y. He was of the opinion that Gen Y employees like to be respected, expect great amount of flexibility and freedom in terms of work culture and working hours. He summarized the features of Gen Y to be,

- working with positive people and like friendly atmosphere
- loving challenging jobs
- not responding to superiors with excessive authority
- interested in self-learning
- treated with dignity and respect
- interested in learning new knowledge and skills
- like flexible work hours, work environment and work schedules
- compensated well proportionate to the work done by them
- long-term career development
- like cross-functional works
- more technology savvy and like technical jobs, usage of multi-media
- connecting with people through social networks.

Table 2: Summary of Traits and Characteristics of Gen Y Employees

Traits and characteristics of Gen Y employees	
Born between 1978 and 2002	Hardworking
50% of workforce by 2020	Challenge lovers
Tech-savvy	Achievement oriented
Friendly	Natural impatient
Self-assured	Multi-tasking
Like Flexibility	Highly mobile and high maintenance

(Jindal, P. and Shaikh, M. (2017)

Job satisfaction and motivation have been widely investigated in many job situations and against many different theoretical formulations. Frederick Herzberg's motivation-hygiene factor theory, although considered non-traditional when it was introduced in 1959, has become one of the most used, known, and widely respected theories for explaining motivation and job satisfaction.

As per Herzberg's two-factor theory (Herzberg, 1967), "There are two distinct sets of factors for job satisfaction and job performance in organizations. One set is labeled as "satisfiers" or "motivators", that results in satisfaction when sufficiently provided. The other set is labeled as "hygiene factors" or "dissatisfiers", that causes dissatisfaction when not fulfilled. The motivators are archetypally intrinsic factors: they are part of job content and come from employees within self. The hygiene factors are extrinsic factors mostly provided by the supervisor or someone other than the employee himself. Most importantly Herzberg's theory did not define satisfaction and dissatisfaction as being two extreme opposite ends of the same continuum. The opposite of satisfaction is not dissatisfaction, but that is no satisfaction. The extrinsic factors affect job satisfaction. If those are not adequately fulfilled, can cause dissatisfaction, even if the motivating factors themselves are addressed reasonably.

Another research on business students' satisfaction and retention in higher education applying the Herzberg two factor theory written by Oscar W. DeShields Jr, Ali Kara, Erdener Kaynak (2006), focused on the determinants of student satisfaction and retention in a college or university that are assumed to impact students' college experience and the results indicate that the path coefficients from faculty and classes to students' partial college experience are consistent with the assumption that the key factors influence student partial college experience. Also, the path coefficient from student partial college experience to satisfaction was consistent with Herzberg's two-factor theory. In addition, students who have a positive college experience are more likely to be satisfied with the college or university than students who do not have a positive college experience.

An additional research paper by Tan Shen Kian, Wan Fauziah Wan Yusoff, Faculty of Technology Management and Business, University Tun Hussein Onn Malaysia (2012) study revealed that both generations X and Y showing some differences in their Intrinsic and Extrinsic motivation factors. It is recommended that organizations should modulate their operations and procedures to properly satisfy two distinct groups of generations.

Further a research studied to comprehend work motivation of seasonal workers at a tourism destination strongly navigated by seasonality (Christine Lundberg, Anna Gudmundson, Tommy D. Andersson (2009). Furthermore, it was examined whether seasonal workers could be divided into worker subgroups on the basis of their work motivation. A SEM tested Herzberg's Two-Factor Theory of work motivation empirically. The results of the study supports the Two-Factor Theory of work motivation. Furthermore, results showed that a migratory community of employees was significantly less concerned about wage level as well as significantly more concerned about meeting new people than resident workers. As a result of these findings, it is suggested that management of businesses in hospitality and tourism need to consider that the seasonal workforce consists of different kinds of worker subgroups, which have different needs to be satisfied.

In some other researches it was indicated that Generation Yers have substantial needs in Extrinsic_ Motivations from their jobs in comparison to earlier generations. Moreover, is was also concluded by Leahy, K., McGinley, J., Thompson, J., & Weese, T. (2011) from their research that Generation have mixed preferences for both Extrinsic and Intrinsic Motivation Factors where as Generation X have higher preferences on Intrinsic Motivation Factors. The reportage commented that across all major fields and industries, job satisfaction levels for new Generation Y professionals_ are plummeting. While another research by Alley (2011) also supported that Generation Y is motivated by Extrinsic Factors more than Intrinsic Factors and they are highly achievement oriented towards value. Furthermore, it was found that Generation_ X give their priorities to Extrinsic Motivations such as fix working hours and job security, while Generation Y give greater importance to Intrinsic Motivation Factors such as Recognitions for their work and sense of achievements received from their community (de Lourdes Machado, M., Soares, V. M., Brites, R., Ferreira, J. B., & Gouveia, O. M. R. (2011)). In a recent study by Zhou (2012) also explained similar result in which Gen Yers are largely affected with their work, more than earlier generations. Moreover, Generation Y employees are less likely to be satisfied with their jobs (Tim, 2012). Lastly, a recent _research _that focuses_ on total of 370 individuals for Work Preference Inventory, has suggested that Generation Y were greatly motivated by Extrinsic Motivation Factors compared to Generation_ X (Shea (2012)).

3. Research Methodology

With the help of Herzberg's two-factor theory, a modified version of the questionnaire was developed and administered to approximately 500 different corporate professionals between the age of 21 to 35 years in Hyderabad. 311 valid responses were studied using correlation analysis and descriptive analysis and the statistically significant factors were outlined.

The questionnaire used for collecting data was constructed using a 5-point Likert scale to understand the importance of each factor for a Gen Y employee. The questionnaire highlighted on the different motivational and hygiene factors such as Company's policies are important to stay with the job and company, Technical support from company, Interpersonal relations with supervisors, Interpersonal relations with peers, Interpersonal relations with subordinates, Salary, Job security, Personal life, Work conditions, Status, Possibility of Growth, Responsibility in job, Achievements in task and position, Recognition for your work, Work itself. This data was collected across experience of the employee and age of the employee.

4. Data analysis

An exploratory approach was used when collecting and analysing the study's qualitative data. The quantitative data of this study tested Herzberg's Two-Factor Theory, which suggests that hygiene factors and growth factors explain work motivation. The answers to the questionnaire were used to identify and measure work motivation of Gen Y employees. The analysis and interpretation of the qualitative data followed Means and Correlation of qualitative data analysis using SPSS.

Table 3: Mean, Standard Deviation and Correlations

HYGIENE FACTORS

	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11
1. Experience	2.32	1.360											
2. Age	2.72	.698	.490**										
3. Company's policies are important to stay with the job and company	4.02	.868	.106	.096									
4. Interpersonal relations with supervisors	3.39	.913	-.294**	-.132*	.160**								
5. Interpersonal relations with peers	3.33	.949	-.284**	-.140*	.160**	.518**							
6. Interpersonal relations with subordinates	3.35	.918	-.349**	-.115*	.222**	.428**	.482**						
7. Technical support from company	3.39	.881	-.219**	-.136*	.217**	.343**	.326**	.274**					
8. Work conditions	3.93	.871	.047	-.097	.255**	.279**	.232**	.140*	.252**				
9. Salary	3.92	.882	.150**	.080	.281**	.146**	.088	.045	.093	.263**			
10. Job security	4.22	.723	.303**	.169**	.193**	-.009	.012	-.025	.020	.333**	.291**		
11. Personal life	3.33	.936	-.249**	-.159**	.210**	.366**	.341**	.302**	.261**	.386**	.243**	.235**	
12. Status	3.13	.889	-.424**	-.266**	.118*	.466**	.458**	.410**	.395**	.237**	.165**	.017	.416**

MOTIVATIONAL FACTORS

	Mean	Std. Dev.	1	2	3	4	5	6	7
1. Experience	2.32	1.360							
2. Age	2.72	.698	.490**						
3. Possibility of Growth	4.181	.8043	.255**	.183**					
4. Responsibility in job	4.17	.731	.304**	.169**	.510**				
5. Achievements in task and position	3.83	.824	.026	-.027	.340**	.316**			
6. Recognition for your work	4.18	.832	.272**	.193**	.565**	.439**	.281**		
7. Work itself	3.36	.940	-.277**	-.108	.175**	.105	.338**	.293**	

N = 311 (employees), * p < .05, ** p < .01

Table 3 displays the means and standard deviations of each factor and correlations between the factors used in the analyses, separately for the Hygiene factors and Motivational factors.

For the motivational factors, higher average values are observed for: Possibility of Growth (4.18), Recognition for your work (4.18) and Responsibility in job (4.17) whereas almost equally high average values are observed for the hygiene factors: Job Security (4.22), Company's policies are important to stay with the job and company (4.02), and Salary (3.92). This could be an indicator that the above three hygiene factors job security, company's policies and salary are very important factors for Gen Y and they could be considered as motivational factors for the generation. This can be an indicator of a paradigm shift in the factors which motivate the Gen Y. In a previous research paper, written by Joseph E. Gawel, The Catholic University of America (1997) on the Herzberg theory of motivation illustrated that salary, possibility of growth, personal life and status being the most predominant factors for Gen X generation. On Herzberg's five motivation factors, achievement ranked as the most important one. However, the overall conclusion drawn from the research is that salary was the single most important influence on the employee decisions.

It is observed from table 3 that Experience is significantly negatively correlated with the hygiene factors: Interpersonal relations with supervisors (-.294**, $p < .01$), Interpersonal relations with peers (-.284**, $p < .01$), Interpersonal relations with subordinates (-.349**, $p < .01$), Technical support from company (-.219**, $p < .01$),

Personal life (-.249**, p < .01), and Status (-.424**, p < .01). Also Age is significantly negatively correlated with the hygiene factors: Interpersonal relations with supervisors (-.132*, p < .05), Interpersonal relations with peers (-.140*, p < .05), Interpersonal relations with subordinates (-.115*, p < .05), Technical support from company (-.136*, p < .05), Personal life (-.159**, p < .01), and Status (-.266**, p < .01). This implies that with gain in experience and age, these hygiene factors become less important to Gen Y. Also, Job Security and Salary are significantly positively correlated with experience and age which further reiterates that they may be considered as motivational factors for Gen Yer's.

In contrast it is observed that Experience is significantly positively correlated with the motivational factors: Possibility of Growth (-.255**, p < .01), Responsibility in job (-.304**, p < .01) and Recognition for your work (-.272**, p < .01). Also, Age is significantly positively correlated with the motivational factors: Possibility of Growth (-.183**, p < .01), Responsibility in job (-.169**, p < .01) and Recognition for your work (-.193**, p < .01). This implies that with gain in experience and age, these motivational factors gain importance among Gen Y.

5. Conclusion

The fundamental purpose of this research was to study the relevant motivation factors for Generation Y employees. Significant differences on extent of satisfaction for both Hygiene and Motivational factors on respondents have been confirmed using statistical calculations. Findings arrived from the study has confirmed that generation cohorts have their own groups of characteristics, aspirations, and workplace expectations that will subsequently lead to different levels of satisfaction for motivation factors. Moreover, among the fifteen factors employed for this study, the factors Job security, Possibility of growth, Responsibility in job, recognition at work, and salary were found to be the most predominant in extent of satisfactions for the Gen Y generations. Surprisingly there is a shift found in the preference of gen y in terms of motivational factors. Salary and job security are becoming motivators for them whereas work itself is just a hygiene factor for them now.

It is recommended that organizations should reinforce the new ideas for motivational factors towards employees in order to stimulate Gen Y employees' satisfaction. Organizations also should review current employee appraiser and feedback systems that will ideally cover multi-generations' work preferences. With effective system execution, employees will be stimulated with better self-recognitions, and higher sense of achievements.

6. Scope for Future Research

The research was limited to only a small population in Hyderabad whereas it can be extended on a larger scale and taken forward for further analysis through confirmatory factor analysis. The research also shows that in present scenario the motivation factors are converted into hygiene factors. Hence companies and organizations need to think more creatively and also discover new motivation factors to retain the Gen Y workforce.

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Kaizen Costing

P A L N S Kalyani*

Abstract

In the view of increasing competition in the world during past decade, US firms have changed radically in their manufacturing procedure and thus their competitiveness has been improved. Many advanced techniques viz., Total Quality Management, Just in Time, Flexible Manufacturing systems, Lean manufacturing, design for manufacturability, process improvement etc, has been adopted to pursue the goal. The aim of the programmes are to improve quality, reduce cost, increase flexibility and reduce cycle time on the floor of the factory. Support systems like cost management and finance are generally not keeping in pace with the level of relative operational changes that are being implemented. The present paper studies about Kaizen Costing and its implementation benefits in detail. It also described about various companies benefited by implementing the technique.

Keywords: Value Engineering, Joint Air-to-Ground Missile (JAGM),

1. Introduction

As defined by Yasuhiro Monden, Kaizen Costing is a system of cost reduction with maintenance of products from the present cost levels to the desired cost level through a systematic effort. Kaizen is a Japaneese Term which connotes continuous improvement.

It is a continuous improvement costing system, a mechanism of managing and controlling costs.

Kaizen Costing is more relatively applicable to comparatively small activities rather than big innovative developments.

As per Monden, Kaizen Costing is of Two Categories

- The activities that are planned as per the exigencies are termed as Asset and organization specific.
- The Activities that are carried out at special projects with special emphasis on value chain analysis - Product model.

The pre requisite for Kaizen Costing is the change in the method of setting of standards.

Kaizen costing focuses on "cost reduction" than "cost control".

The Costs which are related to manufacturing stage are taken into consideration by Kaizen Costing, which include:

i. Supply Chain Cost

ii. Legal costs

iii. Manufacturing costs

iv. Wastage

v. Costs of Recruitment

vi. Sales , Marketing and distribution

vii. Disposal of Product

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On a monthly basis, the technique tracks the cost reduction plans and the targets are expressed in physical resources terms. The team leader is given a target of achieving 1% kaizen costing target and in case of failure, a review by senior member will be followed. Many Japanese firms are strictly controlling resource consumption. Cost reductions are planned and monitored by this technique and the targets are defined in the terms of physical resources.

Rules to be observed for implementation of Kaizen:

- Identify problems on your won
- Mark your problems into Major, minor and difficult
- To start with, select a minor problem and after tackling it, moving to the next level marked problem and continue the same activity.
- Continuous improvement on a routine basis must be ensured.
- Status quo must never be admitted.
- Never reject an idea before trying it.
- The experiments need to be shared with contemporaries.
- By sharing the problems with contemporaries, Eliminate previously tried but failed experiments.
- Never hide any problem, always highlight them.

Principles of Kaizen Costing

- It encourages collective decision making;
- No emphasis will be laid on current situation by disregarding the ideas which are executed in production process.
- Kaizen technique doesn't strive towards perfection. It can improve present situation at an acceptable cost
- Kaizen permits managers to apply their personal skills and knowledge and to exercise discretion
- There is no particular limit for the teams to implement the level of improvement.
- Kaizen works by setting standards and achieve long term sustainable improvements by continuously improving the standards set.
- It focuses on eliminating wastage, improving systems and processes and thus improves productivity.
- It involves all employees and departments.

Merits of Kaizen

- The technique encourages and empowers employees which lead to a better results
- Cost reduction can be ensured through employee suggestion system
- Resources absorption can be reduced through Lean Thinking
- It is applicable to all the types of business organizations
- It helps all the stakeholders in the organization
- It is helpful to build team culture in the organization
- It helps in building leadership skills among the people

- It boosts up the quality of services and thus improves efficiency
- Implementation of this system can improves standardized work documentation
- Implementation of innovative techniques like suggestion system in team meetings, it improves employee satisfaction
- Safety in the organization can be improved by organized and cleanup workspace
- It reduces wastages in the business processes

Limitations of Kaizen

- It is a system that changes permanently
- The technique increases stress on executive management level
- If the technique is not implemented wisely, kaizen costs may lead to diminishing returns
- It may cause frictions in the business processes as many organizations are not prepared to change easily
- The staff and team members need to be provided with training regarding Kaizen methodology
- Old habits die hard is aptly applicable in case of this technique
- In case some departments or few people didn't accept this technique, it may ruin the entire philosophy

Hence, in Kaizen Costing method ensures production of a product while meeting the desired quality, usability, customer satisfaction and reasonable price, to maintain its competitiveness.

Companies Benefitted by implementing Kaizen Costing

Kaizen costing is very adaptable in nature and it is applicable to various sectors includes Banking, Government, Healthcare, retail, transportation etc., It is successfully adopted by people for improving personal lives and achieving development through in house mentoring and life coaching programmes. It was initially coined by Toyota and it has been regarded as best example for its implementation. Kaizen technique is an effective way to gauge the effectiveness and here are the various examples to know how it can benefit a particular case.

Toyota

Kaizen is being used by Toyota, a famous Japanese automotive manufacturer. It has produced and prove with its results which are measurable and extremely effective. It focused on continuous improvement of processes through mini and steady adjustments which enhancing the means things are done. The method was used by Toyoto and also taken the benefit of applying the principles at various levels of organization.

Ford Motor Company

Since 2006 when Alan Mulally was appointed as CEO , Ford has adopted the Kaizen technique. Alan Mulally adopted the same principles at Mark Fields and it helped them to benefit the industry. Ford has implemented the practices for making their processes are more efficient and also finding various methods to save time by surely and slowly, correct the methodologies from time to time and also it ensures that at every phase the operation is repeated and implemented in an effective manner.

Nestlé

Nestle has been one of the famous fast moving consumer goods industries and it is considered as best example of Kaizen's implementation in different industries world wide. Nestle has been successful in achieving great

improvements and reducing waste by lowering materials and time wastage. They have taken the implementation seriously by implementing Lean production. Through Lean Production it has found various ways regarding best usage of available space, resources and utilization of talent and technology.

Mayo Clinic

It is a not for profit, medical research and practice organization which has determined to follow Kaizen by studying how it helps Toyota and knowing how it helps in such complicated production operations and improving the practices.

Mayo Clinic is the best example for Health care sector which is inspired by Toyato. In health care sector – times for waiting, methods, record handling of patients and paramount utilization of resources in which this technique can make a difference.

Lockheed Martin

It is a popular American global security, defence, advanced technologies and also an aerospace company ; it is located in Bethesda. It has approximately 116000 employees across the world and has been selected as one of the Top ten Plans as per Industry Week's during 1998. During the period 1992- 1997, the organization can able to make cost of production to reduce remarkably, by reducing the defect rate to 3.4 case per place and also delivery order timings from 42 months to less than 22 months. It is possible by applying lean manufacturing. They have been awarded with Shingo Prize for Excellence during 2000. They have developed Joint Air to Ground Missle(JAGM) during 2010 and at same instance they also organized various events at Alabama and Florida plants to advance through JAGM process.

Great Western Bank

It is a United states bank working for decades. As per ArgusLeader.com, 34 steps are required for opening a checking account at this bank. After implementing Kaizen, this process has been decreased to 24 steps. Kaizen is used to provide better services to customers and also analyze processes.

Herman Miller

The furniture that can be seen in various movies, television shows and commercial offices is produced by an American office furniture company – Herman Miller. It is well known for producing task chairs.

During 2012, Fast Company – A business magazine reported that they enjoyed 500% increase in productivity and 1000% increase in quality after adopting Kaizen. The chairs which used to take 82 seconds to come off from the line is now can be produced in 17 seconds. Hence, it is proved that Kaizen Principles can be adopted by any type of product ie., chairs to cars.

The Gujarat Government

In India, the world's largest democracy, Gujarat is one of the most significant state. During 2012, Kaizen Institute of India reported that Gujarat government, Education Department, with a motive to improve the functionality of public sector, it has executed 2 weeks of Kaizen training for more than eighty employee. This is one of the best example to prove that it is helpful for not only private sector organizations but also government and municipal organizations.

Conclusion

Kaizen Costing is laid out to redo many value engineering steps until the manufacture of the product continuously working on upgrading the process and thus eliminating the extra costs. Nevertheless, Kaizen Costing is still vital for an enterprise as competitive pressures will force the firms to decrease the product's price over a period of time and also possible savings in the costs facilitate in achieving the intended profit margins while continually working on reducing cost. Manu companies and people are successful through the concept of Kaizen. However, those who are new to this idea are inquisitive to know how exactly it applied in the past. Only few specific organizations are popularly known by adopting Kaizen and achieving best results.

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