Investigation of the MPC Systems Implementation within the Small-Medium Enterprises (SMEs) of Pakistan

Amad-Uddin *
COMSATS Institute of IT
Wah Cantt, Pakistan
uddinamad@live.com

Muhammad Aamir Saeed
COMSATS Institute of IT
Wah Cantt, Pakistan
amirramay_15@hotmail.com

Abstract— The Manufacturing Planning and Control (MPC) tools (such as MRP, MRP II, ERP, CIM, JIT, and TQM) have always gained an important edge in the operations, and productions management of any industrial sector of the world whether dealing with the assembling operations or the manufacturing operations. The MPCs techniques are used essentially to achieve the lowest possible production cost with the eminent quality of products. For any Asian country such as Pakistan whose economy is mostly dependent upon the industry, requires lucrative success and a strong position across the globe by adopting and implementing the nouveau MPC tools. This paper investigates the MPC systems implementation achieved so far within the SMEs of Pakistan and also forecasts the MPC tools future in Pakistan’s industry by using the questionnaire methodology (i.e. survey approach).

Index Term-- Manufacturing Planning and Control (MPC), Small-Medium Enterprise (SME), Questionnaire, MRP, MRP II, JIT, TQM, ERP Tools, and Implementation.

I. INTRODUCTION

The industrial sector especially at manufacturing and management in developing countries is far behind the developed countries due to the low implementation of Manufacturing Planning and Control (MPC) systems such as Material Requirements Planning (MRP), Manufacturing Resources Planning (MRP II), Just-In-Time (JIT), Enterprise Resource Planning (ERP), Computerized Integrated Manufacturing (CIM) and Total Quality Management (TQM). The MPC systems are those tools or techniques used at global level to achieve the high quality products and low production cost [1].

This paper addresses the results of a survey conducted with the help of intensive questionnaire at private and national industrial level in a developing country such as Pakistan to explore how far MPC systems have been implemented in Small-Medium Enterprise (SME) manufacturing companies.

The data was obtained from 41 manufacturing companies with the response rate of over 65%. The conclusions of the survey suggest the current and future status of manufacturing companies in Pakistan under the umbrella of MPC tools implementation.

II. LITERATURE REVIEW

Once the manufacturer has taken the decisions to design a product, manufacturing process and system, his next step is manufacturing planning and control because this function is required for effective, efficient and economical production [2]. Low productivity and effective utilization of scarce resources are the major problems for a company [3]. MPC address decisions on the acquisition, utilization and allocation of production resources to fulfill the customer requirements efficiently and effectively [4].

With the rapid growth of industrialization, specialized inventory Reorder-point (ROP) system for production and inventory control take place i.e. industries use previous data to forecast future demand [5]. If any inventory level falls below, initial inventory is ordered or made new production orders in a fixed quantity [6]. Initially, these ROP systems were manual and automated in 1950 and early 1960s with the introduction of computer.

In the late 1960’s, an effective MPC system approach known as MRP originated and replaced the ROP that played vital role to form inventory strategy effectively in an environment of known demand [7]. In the mid 1970s manufacturing resource planning (MRP II) replaced the MRP and become the primary manufacturing control system.

MPC systems are important for all type of manufacturing industries. It provides guidance for material flow and decides which goals and policies shall be adopted, and provide information how effectively manage the flow of material and how it can be controlled [8]. Effective MPC systems implementation helps organization to get a competitive advantage in the market. Improving and increasing the competitiveness is now an essential for small and large businesses alike [9].

From the early age, MPC tools were only focused on the control of the finished goods but with passage of time these helped in product costing, purchase material and capacity management, production order handling re-reporting.
inventory control and sometimes even customer order handling [10].

III. STRUCTURE OF QUESTIONNAIRE

Looking at the present economy of the Pakistan in which considering the importance of industrial sector as a major development side, an investigation was the idea to look at the current progress of different types of industry dealing with small and medium scale productions. The key aim was to evaluate the implementation of MPC systems because behind every industry economy success, there rests some form of MPC system around the globe.

The questionnaire provides the data concerned with the company’s overall structure covering manufacturing products information, employee’s strength, turnover, knowledge level, and justified reasons and issues behind the MPCs implementation. The questions largely follow, with some modification, those in [11].

The respondents were top level employees from engineers to managers. A total of 59 copies were sent to different SME manufacturing companies. A total of 41 complete copies were received with the response rate of 69.49% as shown in table I.

<table>
<thead>
<tr>
<th>Official designation/Class of respondent</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper management</td>
<td>36.3%</td>
</tr>
<tr>
<td>Intermediate management</td>
<td>24%</td>
</tr>
<tr>
<td>Lower management</td>
<td>9.19%</td>
</tr>
<tr>
<td>Total</td>
<td>69.49%</td>
</tr>
</tbody>
</table>

Questionnaire was sent to variety of business oriented SMEs. These SMEs include building parts, metal, petrochemical, food products and other industries as shown in table II. The number of workers and variety in manufacture products are also mentioned in the same table. The turnover per year has not been discussed due to confidential as requested by number of respondents.

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>No. of SMEs</th>
<th>No. of workers</th>
<th>No. of Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weapon industries</td>
<td>2</td>
<td>800</td>
<td>7</td>
</tr>
<tr>
<td>Building parts industries</td>
<td>12</td>
<td>1058</td>
<td>37</td>
</tr>
<tr>
<td>Textile industries</td>
<td>3</td>
<td>475</td>
<td>10</td>
</tr>
<tr>
<td>Paper industries</td>
<td>3</td>
<td>500</td>
<td>8</td>
</tr>
<tr>
<td>Food products industries</td>
<td>24</td>
<td>2700</td>
<td>28</td>
</tr>
<tr>
<td>Metal industries</td>
<td>7</td>
<td>2270</td>
<td>6</td>
</tr>
<tr>
<td>Petrochemical industries</td>
<td>6</td>
<td>1050</td>
<td>3</td>
</tr>
<tr>
<td>Wood industries</td>
<td>2</td>
<td>350</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>9203</td>
<td>101</td>
</tr>
</tbody>
</table>

IV. RESULTS AND ANALYSIS

A. Why MPC systems in Pakistan?

The questionnaire included a question on the key causes which motivate the organization top management to implement MPC system. The survey which we have conducted, approximately 70 % of companies replied and some of them which are not implementing or have no awareness show interest to guide them to implement the system. The companies which have their MPC systems due to competition is 5% and 2% implement only due to experiment. Remaining 93% companies have systems due to their top management decisions. These statistics are summarized in figure 1.

![Fig. 1. Key causes of implementation of MPC systems](image)

B. Knowledge level of MPC systems in Pakistan

The awareness or knowledge level of SMEs is also judged by the questionnaire and it is interestingly observed that about 41.3% understand the MPC system, 48.4% have no idea about these systems and among responded companies, 10.3% companies did not response to this question. This reflects that there is a lack of knowledge and communication gap between top management and system users as well as lack of proper training. Figure 2 summarizes the results below.

![Fig. 2. Knowledge level of MPC systems](image)

C. Importance of MPC systems in Pakistan

41.3 % respondents, which understand the MPC systems as shown in fig 2, give surprising answers to the sub-question of knowledge level in which it is observed that about 45.1 % are analyzing the importance of MPC systems due to benefits or competition in the manufacturing market whilst 34.5% are not in favor of advance techniques of production and 20.4%
respondents did not respond to this question. These statistics are summarized in fig 3.

![Fig. 3. Importance of MPC systems](image)

**D. Present status of MPC systems implementation in Pakistan**

The possible answers to the questions about the implementation of MPC systems are coded by different patterns covering four categories i.e. fully computerized (FC), semi computerized (SC), manual, not at all (NA), and statistics of the present status of MPC system summarizes in the figure 4.

In figure 4, it is clear that more than half of the SME companies have not implemented MRP II, AUTO, CIM, SIC, JIT, and TQM. Nearly from 13% to 20% implemented them fully except MRP II and SIC. MRP and ERP percentages decline little less but more than half of the companies implemented them. ERP with FC 46.6% implementation percentile is at the top than any other MPC tool. About 13.3% companies have manual MRP which is comparatively higher than other systems.

Therefore, from the figure 4, it is clear that few companies have implemented MPC systems with an overall average of 16.3% FC, 12.4% SC, 7.7% manual, and 63.4% NA.

![Fig. 4. Present implementation of MPC systems with percentage statistics](image)

**E. Future consideration regarding MPC systems implementation in Pakistan**

One of the key reasons behind the survey was to know about the future of MPC tools in SMEs of Pakistan. Based on observed statistics in fig 5 it is surprisingly noted that slightly more than one-third of the SMEs firms have shown willingness for MPC tools implementation. The MRP, ERP, and TQM systems gain attention for future consideration as 30.7 % of respondents show complete installation intention.

![Fig. 5. Future implementation of MPC systems with percentage statistics](image)

**F. Overall comparison of current and future of MPC tools in Pakistan**

Figures 4 and 5 show the current and future consideration status of MPC tools under the four categories from FC to NA. The detailed comparison is shown in figure 6 which gives a very clear vision of MPC tools in Pakistan at present and future based on the data available in fig 4 and 5 from fully-computerized to manual (excluding the NA category and summing up the percentages of FC, SC, manual).

![Fig. 6. Comparison of current and future of MPC tools](image)

TQM, JIT, ERP, and MRP are the selected tools by SMEs for future consideration in next eight to ten years and their
planning and implementation percentage w.r.t current is far high such as TQM from 31% to 79%, JIT from 33% to 71% approximately. MRP ranges from 45% to 65% and ERP from 49% to 69%. No other noticeable variation is observed in any other MPC tool. Therefore, there is no appreciable interest of SMEs in future for other MPC systems as can be seen in figure 6 because of reasons of less flexibility, high investment, low output and complex production control.

V. CONCLUSION

A number of conclusions are observed by this work. One of the paper findings reveals that majority of Pakistan’s SMEs have planned the installation of MPC systems and minority have installed them. This indicates the rise of knowledge or awareness of benefits of management of production control and material handling.

The paper also gives an idea that many SMEs do not have foreign partner and hence it is one of the issues of less implementation of MPC systems in Pakistan. A key possible reason is that these systems require large investments which is quite risky under the existing jeopardize economy of Pakistan for the foreign partners. The paper also reflects that even though upper management knows the benefits of MPC systems but SMEs did not prefer to install because of lack of training, communication or knowledge gap between lower to upper management and system users.

Furthermore, currently MRP, ERP, TQM, and CIM are being used slightly in greater proportion comparatively to other MPC tools. The paper even forecasts the future of MPC systems implementation based on questionnaire response which is slightly over 63% that SMEs have no intention to install or update the MPC tools.

The paper also finds that MRP, ERP, TQM, and JIT are being considered for implementation in future by SMEs that do have these systems, hence updating and tending towards fully computerized tool. Only TQM, JIT, and MRP are considered for newly installation by one-third of the SMEs that do not contain these tools.

This work is very beneficial and can be extended, analyzed, implemented, and studied in more detail statistics for large enterprises (LEs) of Pakistan. This paper gives an insight view and progress of Pakistan’s SME industry in the world dealing with modern MPC tools under the destabilize phase of economy and financial crises.

REFERENCES


Mr. Amad-Uddin is a Lecturer at Engineering Department, COMSATS Institute of Information Technology, Pakistan, since 2008. He received a master degree in mechanical engineering from the School of Engineering, Design, & Technology at University of Bradford, UK in 2008 and bachelor degree from UET Peshawar, PK in 2007 . His research interests include manufacturing planning & control systems (MPCS), modelling & simulation of control systems, and teaching interests include dynamic systems, mechanical vibrations, thermodynamics and solid mechanics. He can be reached at uddinamad@live.com