Implementation of Advanced Manufacturing Technology in Manufacturing Businesses of Pakistan: A Contingency Approach

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ABSTRACT

The purpose of the research is to test the impact of Advanced Manufacturing Technology (ADMATECH) on Management accounting (MACCT) along with the impact of both of these variables i.e. ADMATECH and MACCT on company's performance (CPF). Further the mediating role of MACCT system between ADMATECH and CPF was also analyzed. Data from 263 manufacturing companies of Pakistan was collected through questionnaire that was taken from different researches. ADMATECH, MACCT and CPF were taken as exogenous, mediating and endogenous variables respectively. To analyze the contingency model of MACCT practices different test were applied that includes validity, reliability and regression. For all these analysis version 23 of SPSS was used. The outcomes showed that the usage of ADMATECH has no effect on CPF i.e. there is an insignificant influence of ADMATECH on CPF. Further results showed that ADMATECH has an effect on the usage of MACCT system i.e. ADMATECH has a significant influence on MACCT system. So it can be said that implementation of ADMATECH stresses on greater usage of MACCT system. Results have also indicated a significant influence of MACCT practices on CPF. This means MACCT system help corporations to compete in competitive environment which ultimately improves CPF. Finally it was also found that the link between AMATECH and CPF was indirect via MACCT i.e. MACCT is a full mediator between ADMATECH and CPF. According to researcher's knowledge about Pakistan, the relationship between these three factors have not been explored in Pakistan. So the researcher has tried to find out the relation between these three variables i.e. ADMATECH, MACCT and CPF. The outcomes of this research will assist managers of these companies in determining whether the usage of ADMATECH is beneficial to increase CPF, with the mediating role of MACCT system. Further this study could assist top management of manufacturing businesses towards technical alliance with ADMATECH manufacturers for designing and developing of products.

Keywords: *Company Performance, Contingency Model, Management Accounting, Manufacturing Companies.*

INTRODUCTION

The research was carried out to test the impact of Advanced Manufacturing Technology (ADMATEC) on management accounting (MACCT) along with the impact of both of these variables on i.e. ADMATECH and MACCT on company's performance (CPF). The direct as well as indirect impact of ADMATECH through the mediating role of MACCT system between ADMATECH and CPF was also analyzed. Manufacturing sector of Pakistan is like a back bone for its economy having a contribution of around 20.9% in the GDP and has shown growth rate of 5.82% in 2016/2017. Share of exports of manufacturing goods is approximately

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75%. Due to such an imperative role of manufacturing sector this research was carried out only on this sector. Further this will also eliminate the distortion in results occurring due to different mix of sectors.

Rise in globalization and fast progressions in production and information technologies (ITs) have led to more fierce international competitive and production environment. Sometimes, due to high competition and economic conditions of country, businesses have to face tough situation and decline in performance. As a result various methods are employed by corporations to enhance their performance, which includes continuous improvement in production processes, but still many find it difficult to maintain their position in the market. To flourish and survive in such type of environment, corporations need to be vigilant and alert to the varying requirements of their local and global markets. This will entail companies to constantly appraise and revamp their production procedures and strategies, which includes implementation of ADMATEC (Dean & Snell, 1996). ADMATEC is among the integrated production systems implemented by corporations for reducing costs; improving quality, and for faster production processes so that the continuous improvements can be ensured (Dean & Snell, 1996). Substantial changes in the structure of production cost results due to adoption of ADMATEC along with substantial increase in overhead costs and decrease in direct labour costs. The usage of ADMATEC in businesses effects not only application of MACCT systems but also improves CPF. According to Thakur LS, Jain VK (2008) companies can achieve competitiveness through ADMATEC. Ahmad et al. (2014) found ADMATEC as one of the internal factors that effects CPF. Similarly Bourke & Roper (2016) found clear and significant benefits of ADMATEC for innovation.

Increasing interest of researchers towards this area was due to the ineffectiveness of conventional MACCT in ADMATECH environment (i.e. Sillince & Sykes, 1995; Davila & Wouters, 2007). It has been discussed that companies might utilize strategic MACCT systems to match the existing requirements of information, as the conventional MACCT system is unable to furnish timely and pertinent information (Williams and Seaman, 2002; Mia & Winata, 2008; Mia & Clarke, 1999). Thus alterations in MACCT system are crucial because the role of MACCT system is very significant as it monitors the strategic advancement of corporation through an information system of feedback. Several studies have been carried out to analyze the impact of ADMATECH on MACCT. According to a study carried out by Isa & Foong (2005) in Malaysia, ADMATECH has a significant relation with MACCT change. Nair1 & Soon Nian (2017) found that MACCT system is influenced by fierce competition from both internal that includes ADMATECH and external aspects. Ahmad et al. (2014) also found dependence of MACCT practices on internal and external factors.

As far as effect of MACCT systems on CPF is concerned researchers have claimed that the usage of pertinent information related to MACCT might assist companies to attain their performance target that will consequently increase CPF. According to Mia & Clarke (1999), usage of information related to MACCT system in extreme competition of market resulted in improvement of financial as well as non-financial performance (NFPER). Similarly, Mia (2000) has also found a link between information related to MACCT and higher financial performance in companies following Just in time (JIT) approach. Abdel Al, & McLellan (2013) have found a significant effect of MAACT on CPF. According to Ahmad et al. (2014) MACCT systems are vital as it helps company's management in better decision making and in

competing effectively. However, it is not evident that whether in ADMATECH environment, usage of MACCT system will help companies to enhance their performance. It is anticipated that organizations working in ADMATECH environment face aggressive and highly competitive business conditions, which force them towards the usage of more sophisticated management control methods so as to survive the opposition and achieve competitive advantages. It is therefore, essential to extend these researches by investigating the usage of ADMATECH system so as to improve performance of company. According to researcher's knowledge about Pakistan, the relationship between these three factors have not been explored in Pakistan. So here the researcher has tried to find out the relation between these three variables i.e. ADMATECH, MACCT and CPF.

The rest of this paper is structured as follows. Coming section shows the literature review along with the hypotheses, and then methodology and results are discussed in next section. The last section contains discussion, limitations and conclusions.

Literature Review And Hypotheses Development

Contingency Theory

Contingency theory has been used in this study as a foundation to discuss the relationship between ADMATECH, MACCT system and Companies performance (CPF). Amara & Benelifa (2017) have considered ADMATECH as one of the important contingent factors that effects MACCT system. The contingency approach to MACCT is established on the principle that there is no universally suitable system of accounting that can be applied similarly to all corporations in all situations (Otley, 1980). Thus it is proposed that specific features of suitable accounting system depends on the precise situations of corporations. A contingency theory needs to ascertain precise features of an accounting system with particular defined situations and exhibit a suitable match. The usefulness of an accounting system is contingent on its ability of revamping to variations in external situations and internal aspects. Due to severe competition these days, the production processes turn out to be more complex due to which more sophisticated technologies are required. According to Chenhall (2003) modern technologies such as flexible manufacturing (FM), Total quality management (TQM) and Just in time (JIT) become the new contextual aspects of technology. The researcher proposed that the application of ADMATECH would change the approach of managers regarding usage of MACCT system information. More broad information would be required by them so as to match these latest and advanced production environments. The contingency approach assumes that MACCT systems are implemented so that the managers can be assisted in attaining the anticipated outcomes of the company. Eventually the final task of all corporations is to attain the maximum performance level as probable. To materialize this, each corporation according to the availability of resources and capabilities should set its own performance target. So here, contingency theory discusses the link among ADMATECH implementation, MACCT systems and CPF. It is suggested that the implementation of ADMATECH effects the usage of MACCT systems information by managers in order to improve performance. The research framework is established on the basis of contingency theory and is shown on Figure 1.

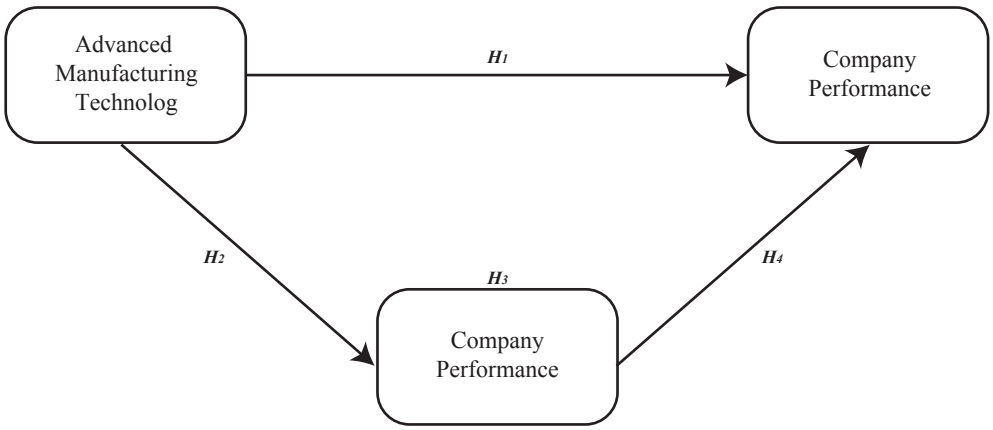

Figure 1: Theoretical Framework of the Study

Advanced Manufacturing Technology (ADMATECH) and Performance (CPF)

Advanced Manufacturing Technology (ADMATECH) and Performance (CPF)
The impact of globalization and the progression in technologies have changed the business environment completely. As for manufacturing corporations, these rapid changes have impacted on the costing, processes and controls of these corporations. There is a need for these corporations to review their methods to be able to stay competitive against their rivals. Implementation of ADMATECH is one of such methods. Corporations adopt ADMATECH as a part of their strategies to enhance performance. ADMATECH might improve CPF due to its capability of producing products in bulk with fast production process. However, according to past researches mixed results have been found as far as the link between ADMATECH and CPF is concerned. Such as Jaikumar (1986); Kotha & Swamidass (2000) have found that ADMATECH is linked with performance, however Dean & Snell (1996) have found else. Again Baines, A., & Langfield-Smith, K., (2003) found that to stay competitive and to increase flexibility, level of output and to reduce costs, companies should invests in ADMATECH. According to Gómez & Vargas (2012) there is a positive association between export intensity and ADMATECH. Kong, Feng & Ye (2016) have found adoption of ADMATECH as a main driving force of innovation.

However, the expectations of implementers are not met by ADMATECH projects (Percival & Cozzarin, 2010) due to which difficulties are faced by them and the expected benefits are not converted in actual competitive advantage. Due to these mixed findings, the researcher has tried to evaluate the link between ADMATECH and performance. Moreover, the above researches were carried out in developed countries and the relation between them needs to be made clear with respect to developing countries specially Pakistan. The importance of ADMATECH is evident as companies are adopting it in spite of huge capital requirement. Hence, the researcher has expected a positive link between ADMATECH and performance which resulted the given below hypothesis:

H_1: Implementation of ADMATECH has a positive impact on CPF.

Advanced Manufacturing Technology and MACCT Information

MACCT system information denotes to that information that is furnished in corporation by MACCT system (Chenhall & Morris, 1986). For couple of year the usage of traditional MACCT techniques in companies is limited to some extent. It is expected that MACCT system just provides information on historical, financial and internal matters, so it is considered as having a narrow scope (Chenhall & Morris, 1986; Mia, 1993). Though, MACCT system has been evolving to transform according to new competitive conditions. The new MACCT system provides wider scope of information that is related to both external and non-financial matters. These alterations are essential so that the claims of Johnson & Kaplan (1987) among others can be corrected, that figures generated by MACCT system is outdated and should be altered so as to adapt to new conditions of business. The implementation of ADMATECH would necessitate the usage of MACCT system information that could assist their implementation. The gap was addressed by Mia & Clarke (1999) that managerial usage of MACCT system needs to be tested in new situations which includes the utilization and assessment of new production technology i.e. JIT manufacturing systems and CAD/CAM. Szychta (2002) also found that technology is considered as a driving force behind the variation in application of MACCT system in Poland. Ahmed (2012) has also described the positive and significant link between the use of ADMATECH and MACCT practices. Leite et al.'s (2015) have found a rapid evolution of ADMATECH in textile sector in current decade. The outcome of their research showed a significant and positive relationship of ADMATECH and MACCT practices. Nair & Soon Nian (2017) have identified ADMATECH among other factors affecting MACCT practices. Hence, through this study the researcher has attempted to fill the gap with respect to Pakistan by analyzing the given hypothesis:

H_2: Implementation of ADMATECH has a positive impact on MACCT practices.

MACCT practices and Performance

It is anticipated that the information provided by MACCT system helps corporations to compete in competitive environment by furnishing information that is beneficial for management decisions which ultimately improves CPF. However Amara & Benelifa (2017) have found that MAACT system should be designed according to new requirements, as MACCT systems are growing with the diversity of functions and size of businesses (Oyewo, 2017).

According to Mia (1993), the utilization of information generated through MACCT system can assist managers to make more correct decision, which will finally improve CPF. Through extensive usage of MACCT practices CPF can be improved (Chenhall & Morris, 1995). According to Askarany & Yazdifar (2017) full implementation of a MACCT technique i.e. Balances Score card can contribute towards CPF. Sim & Killough (1998) found that CPF that have adopted TQM or JIT is better than others if the information furnished by MACCT system is used by them. Similarly Mia (2000) also agreed that companies using MACCT information in JIT environment are performing better than those that are not using JIT approach. In severe market competition usage of MACCT information has resulted in enhance performance (Mia & Clarke, 1999). So according to the discussion, a positive link is expected between MACCT practices and performance. Hence the hypothesis of the current study is:

H_3: Utilization of MACCT practices has a positive impact on performance.

Advanced Manufacturing Technology, MACCT and Performance

Literature have shown that usage of ADMATECH in isolation is not sufficient and it should be supported by other aspects also to improve CPF (Marri, Irani, & Gunasekaran, 2007). According to outcomes of different researches the relationship between ADMATECH – CPF is complex. Some researchers have proved that the relationship between ADMATECH– CPF is either mediated (Choe, 2004; Patterson, West, & Wall, 2004) or moderated (Lewis & Boyer, 2002; Zhang, Vonderembse, & Cao, 2006) by other factors. Study carried out by (Ismail & Isa, 2011) found that MACCT scope plays a mediating role between ADMATECH and performance. If at least a partial relationship exists between independent and dependent variable through third variable, the third variable is said to be intervening or mediating variable between these variables (Mia, 1993; Mia and Clarke, 1999). So, if both the hypotheses i.e. H2 and H3 are supported, then, MACCT plays a mediating role between ADMATECH and performance as shown in Figure 1.

H_4: Utilization of MACCT practices plays a mediating role between ADMATECH and performance.

METHODOLOGY

Research Design

According to Hair et al., (2007) research design displays the standard procedures for undertaking the task. Specifically it should furnish required information to deal with hypothesis and research questions. In current study the researcher has tested cause and effect relation i.e. as stated by Saunders et al., (2009) it to be an explanatory research. Questionnaire based survey was used as a main source of data gathering. It represents a quantitative data gathering method. Google form was used to design the questionnaires and the link was send to the participants, i.e. personal of manufacturing companies of Pakistan. The population for current study is all the production companies having its operation in Pakistan. Analyzing only one sector will eliminate the distortion in results occurring due to different mix of sectors. Non-probability sampling i.e. convenience sampling technique was utilized to collect data from 263 companies. According to Henry (1990) this type of method is very attractive for researcher due to its easiness, promptness and cost effectiveness in collecting data. However here, this method was used as management of manufacturing companies is reluctant to disclose their data even of subjective nature. Personals at management level were requested to fill the online questionnaire as they are more responsible towards company performance and are also more aware of ADMATECH and MACCT practices.

Data Analysis and Measurement

According to Long (1997), multiple regression analysis is one of the most commonly utilized statistical methods in social sciences. For current study the researcher has used the same method. Further Hayes (2013) found that process modelling can be used in that research which consists of impact through two pathways i.e. direct effect (X on Y) and indirect effect through (M), the mediating variable. This is also known as mediation analysis. According to Baron and Kenney (1986) mediation can be of two types i.e. Partial or Full. There will be a partial mediation if product of paths i.e. from X to M and M to X is greater than significant X to Y path, whereas there will be full mediation if both the paths i.e. X to M and M to Y are significant and positive but due to mediator X to Y becomes insignificant. The researcher has tried to analyze the mediating effects of MACCT practices between ADMATECH and

performance. However, reliability and validity was initially checked by using cronbach's alpha and Average variance extracted, so as to reduce measurement error. For all these analysis version 23 of SPSS was used along with process macro.

Advanced Manufacturing Technology

ADMATECH consists of 9-item scale to measure the extent of implementation of computer technologies in companies manufacturing processes. The items were adopted from Askarany & Smith (2008). Implementation of ADMATECH was measured on a scale of 1 = (None) (If the company is not using the technology or it is not applicable in that company), to 5= (very great deal).

MACCT system

MACCT consists of 6-item scale to measure the extent of implementation of MACCT methods in manufacturing companies of Pakistan. The items were adopted from questionnaire of earlier researches carried out by Drury et al. (1993), Sulaiman & Mitchell (2005) and Abdel-Kader & Luther (2006). Implementation of ADMATECH was measured on a scale of 1 = (None) (If the company is not using that MACCT technique or it is not applicable in that company) to 5= (very great deal).

Business Unit Performance

In current research the items of CPF are similar to those used by Baines & Langfield-Smith, (2003), Abdel-Maksoud et al. (2008) & Jusoh & Parnell (2008). The CPF shows the extent to which business was successful in attaining its targets which were measured here through nine financial and non-financial items. The respondents were requested to indicate their expected CPF by using scale ranges from 1 = Decreased significantly to 5 = Increased significantly.

DATA ANALYSIS

Correlation Matrix

Table 1 shows the correlation matrix through which issue of multicollinearity has been checked. From Table 1 it is evident that the issue does not persist as the correlation between variables is not high i.e. 0.8 or above.

Table 1: Correlation Matrix

	CPF	ADMATECH	MACCT
CPF	1	0.372	0.512
ADMATECH	0.372	1	0.580
MACCT	0.512	0.580	1

Reliability and Validity

Before testing hypotheses, adequacy of measurement model is evaluated through validity and reliability. Consistency of different measures can be tested through reliability. In SPSS this can be done through Cronbach's alpha. According to Hair et al. (1998), value greater than 0.70 shows that the measure is highly reliable whereas if the value is lower than 0.70 it shows lack of reliability. Reliability results of CPF, ADMATECH and MACCT are shown in Table 2 and it is clear that that all constructs are reliable.

Table 2: Reliability

Variables	No of Items	Cronbach's α
CPF	09	0.878
ADMATECH	09	0.904
MACCT	06	0.805

According to Fornell & Larcker (1981) for convergent validity the AVE of individual construct needs to be at least 0.50 and for discriminant validity the square root of AVE must be higher than the values found out through square of correlation between the variables. Results of both validities are shown in Table 3.

Table 3: Discriminant Validity

Particulars	CPF	ADMATECH	MACCT
CPF	0.72		
ADMATECH	0.14	0.76	
MACCT	0.26	0.34	0.72
AVE	0.513	0.582	0.512

Table 3 shows the values of AVE i.e. 0.513, 0.582 and 0.512 for CPF, ADMATECH and MACCT respectively, whereas square root of AVE is 0.72, 0.76 and 0.72 for CPF, ADMATECH and MACCT respectively. Correlation squares are shown in off diagonal columns. Hence, it proves both the validities in research model.

Hypotheses Testing

Hypotheses of current study were tested through examining coefficient value (β), significance values (ρ) and values of r2 for dependent variable. Results are shown in Figure 2.

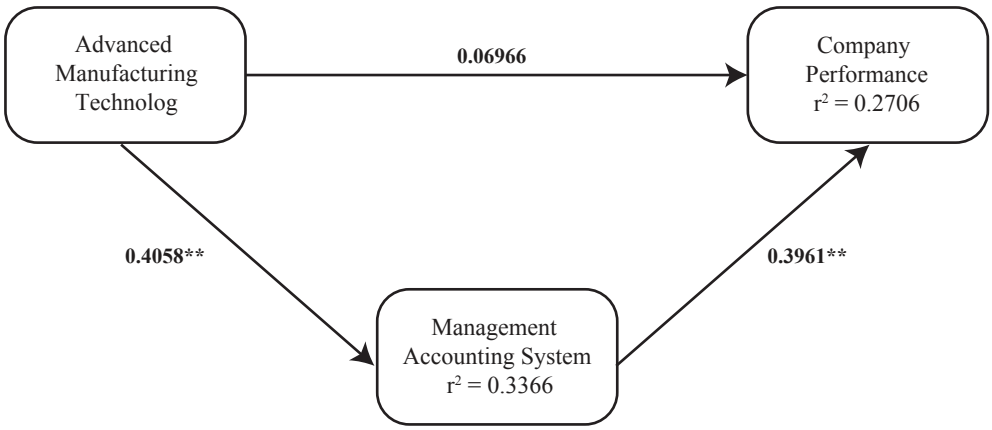

Figure 2: Results of Overall Model.

H_1 depicts the impact of ADMATECH on CPF of manufacturing corporations of Pakistan with the (coefficient of (0.0696) and $p > 0.05$, i.e. 0.0855). This indicates an insignificant influence of ADMATECH on CPF of manufacturing corporations of Pakistan which is line with researches of (Dean & Snell, 1996; Percival & Cozzarin, 2010). Hence fails to reject H_0.

H_2 depicts the influence of ADMATECH on MACCT practices in manufacturing corporations of Pakistan with the (coefficient of (0.4058) and $p < 0.01$, i.e. 0.000). This indicates a significant influence of ADMATECH on MACCT practices of manufacturing corporations of Pakistan and this result is in line with (Szychta, 2002; Ahmad, 2012 and Nair & Soon Nian, 2017). Hence H0 is rejected. H3 depicts the impact of MACCT practices on CPF of manufacturing firms of Pakistan with the (coefficient of (0.3961) and $p < 0.01$, i.e. 0.000). This again indicates a significant influence of MACCT practices on CPF in manufacturing corporations of Pakistan and is also in line with (Chenhall & Morris, 1995; Mia, 2000; Askarany & Yazdifar, 2017). Hence H0 is rejected. Summarized results are shown in Table 4.

Table 4: Regression Results

Hypothesis	Coefficient	SE	p
H_1	0.0696	0.0403	0.0855
H_2	0.4058	0.0353	0.0000
H_3	0.3961	0..0576	0.0000

Mediation Effect

After analyzing an insignificant association between ADMATECH and CPF, the mediation regression analysis was used to check the indirect effect of ADMATECH on CPF. To analyze the mediating effects of MACCT practices between ADMATECH and performance, same procedure has been used as suggested by Baron & Kenney (1986). Following conditions needs to be met for full mediation. An insignificant path from independent variable (IV) i.e. AMATECH, to dependent variable (DV) i.e. CPF, but a significant paths from independent variable (AMATECH) to mediator i.e. MACCT and from mediator (MACCT) to dependent variable (CPF) (Wold, 1985). Here, MACCT is fully mediating the link between ADMATECH and performance and is in line with Patterson, West, & Wall, (2004). Another way to analyze the mediating effect is to check whether 0 lies between LLCI and ULCI. According to Preacher & Hayes (2004) research, it can be concluded that indirect effect is significantly different from 0, if zero does not lays between LLCI and ULCI at 95% confidence interval. So here it is clear from Table 5 that 0 does not lays between LLCI and ULCI i.e. (0.1016 – 0.2402). Hence H0 is rejected which means that MACCT practices is a mediator between ADMATECH and CPF.

Table 5: Mediation Effect

Hypothesis	Coefficient	SE	LLCI	ULCI
H_4	**0.1607**	**0.0356**	**0.1016**	**0.2402**

Summary of results related to alternate hypotheses are presented in Table 6

Table 6: Summary (Hypothesis Testing)

Hypothesis		Rejected/ Supported
H_1	Implementation of ADMATECH has a positive impact on CPF.	Rejected
H_2	Implementation of ADMATECH has a positive impact on MACCT practices.	Supported
H_3	Utilization of MACCT practices has a positive impact on CPF.	Supported
H_4	Utilization of MACCT practices plays a mediating role between ADMATECH and CPF	Supported

DISCUSSION AND CONCLUSION

The expansion in technologies has enforced production companies to adopt ADMATECH to achieve competitive advantages. It was found in current study that the usage of ADMATECH would affect the usage MACCT system, which will consequently affect CPF. So it can be said that implementation of ADMATECH stresses on greater usage of MACCT system. The outcome is consistent with that of Chenhall (2003; 2007), that ADMATECH such as flexible manufacturing systems are related to management control system. The outcomes of this research are similar to that of Otley (1980), Szychta (2002), Patiar & Mia (2008), Ahmad et.al. (2012) and Askarany & Yazdifar (2017) among others that the usage of information related MACCT system might result in improvement of CPF. Burns, J., & Scapens, R., (2010) found that due to globalization the function of management accountant have progressed from record keeper to formulator, implementer and appraiser of strategy. For making effective and timely decisions related to business, managers require more integrated and timelier data from (MACCT) system. So, corporations that are large in size should use sophisticated MACCT systems in order to make decisions on product costing (Ahmad et al, 2014). The final outcome showed that the link between AMATECH and CPF was indirect via MACCT, as found out by Dean & Snell's (1996) that ADMATCH and CPF are not linked significantly. So AMATECH shall be backed with human competence for efficient operation (Singhry, Abd Rahman, & Imm 2016). Team approach should be encouraged by management while adopting MACCT practices. All key departments should work in liaison with management to ensure the application of right MACCT system when ADMATECH are being utilized in manufacturing processes.

LIMITATION AND FUTURE DIRECTIONS

There are couples of limitations to the research that are highlighted here along with the recommendations for future researches. Initially, the sample was selected only from manufacturing corporations having its operation in Pakistan. For future researches other sectors can also be included. Secondly the utilization of ADMATECH and the usage of MACCT might be different in other regions. Thus, generalization of the outcomes to other countries is not possible. For future studies it can be extended to other countries also. Thirdly the questionnaire was prepared to collect data at one point of time rather than longitudinally. Longitudinal data can be collected in future. Finally other contextual variables have not been taken into consideration which might also affect the relationship among ADMATECH, MACCT and CPF. These variables can also be taken for future studies. Irrespective of these limitations, this research furnishes evidence regarding the mediating impact of MACCT

between ADMATECH and CPF. The outcomes of this research assist managers of these companies in determining whether the usage of ADMATECH is beneficial to increase CPF, with the mediating role of MACCT system. Experts can research further between traditional and new MACCT practices as it is necessary to implement MACCT practices in developing countries due to its lower usage. This study could further assist top management of manufacturing businesses towards technical alliance with ADMATECH manufacturers for designing and developing of products. Technical alliance between principal corporations and ADMATECH manufacturers might enhance their productivity, agility and mutual benefits. This will create goodwill for ADMATECH manufacturers and ultimately results in better long term association and profits. Further with respect to ADMATECH manufacturers and MACCT users this research is important as it will help both of them to identify difficulties under collaborative environment and guide them to alter their systems to meet the requirement of business. This will further help them to design future systems that are user friendly and firm specific.

REFERENCES

Abdel-Kader, M. and Luther, R. (2006). Management accounting practices in the British food and drinks industry. *British Food Journal*, 108(5), 336-357.

Abdel-Kader, M. and Luther, R. (2008). The impact of firm characteristics on management accounting practices: A UK-based empirical analysis. *The British Accounting Review*, 40(1), 2-27.

Abdel-Maksoud, A., Asada, T. and Nakagawa, M. (2008). Performance measures, managerial practices and manufacturing technologies in Japanese manufacturing firms: state-of-the-art. *International Journal Business Performance Management*, 10(1), 1-16.

Ahmed Abdel-Maksoud, Wagdy Abdallah, Mayada Youssef (2012). An empirical study of the influence of intensity of competition on the deployment of contemporary management accounting practices and managerial techniques in Egyptian firms. *Journal of Economic and Administrative Sciences*, 28(2), 84-97.

Ahmad, K. (2012). Factors explaining the extent of use of management accounting practices in Malaysian medium firms. Retrieved from http://eprints.uthm.edu.my/3350/

Ahmad, N. S. M. & Leftesi, A. (2014). An Exploratory Study of the Level of Sophistication of Management Accounting Practices in Libyan Manufacturing Companies. *International Journal of Business and Management*, II (2), 01–10.

Amara, T., & Benelifa, S. (2017). The Impact of External and Internal Factors on the Management Accounting Practices. *International Journal of Finance and Accounting*, 6(2), 46–58

Askarany, D., & Smith, M. (2008). Diffusion of innovation and business size: A longitudinal study of PACIA. *Managerial Auditing Journal*, 23(9), 900-916.

Askarany, D., & Yazdifar, H. (2017). Management Accounting and the Shortcomings of Current Performance Measurement Systems. *International Journal of Accounting Research*, 5(1). https://doi.org/10.4172/2472-114X.1000146

Baines, A., & Langfield-Smith, K. (2003). Antecedents to management accounting change: a structural equation approach. *Accounting, Organizations and Society*, 28, 675-698.

Baron, R.M. and D.A. Kenny, (1986). The moderator–mediator distinction in social psychological research: Conceptual, strategic, and statistical consideration. *Journal of Personality and Social Psychology*, 51(6), 1173–1182.

Bourke, J., & Roper, S. (2016). AMT adoption and innovation: An investigation of dynamic and complementary effects *Technovation*, 55–56, 42–55. https://doi.org/10.1016/j.technovation.2016.05.003

Chenhall, R.H. and D. Morris, (1986). The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems. *The Accounting Review*, LX1(1), 16-35

Chenhall, R.H. and D. Morris, (1995). Organic decision and communication processes and management accounting systems in entrepreneurial and conservative business organizations. *Omega*, 23(5), 485-497.

Chenhall, R.H., (2003). Management control systems design within its organizational context: findings from contingency-based research and directions for the future. *Accounting Organizations and Society*, 28, 127–168.

Chenhall, R.H., (2007). Theorizing contingencies in management control systems research. In Chapman, C., A. Hopwood, and M. Shields, (Ed.), *Handbook of Management Accounting Research* (2), Elsevier.

Choe, J.-M. (2004). Impact of Management Accounting Information and AMT on Organizational Performance. *Journal of Information Technology*, 19(3), 203-214.

Davila, T. and M. Wouters, (2007). Management Accounting in the Manufacturing sector: Managing costs at the Design and Production stage. In Chapman, C., Hopwood, A. and Shields, M. (Ed.), *Handbook of Management Accounting Research* (Vol. 2), Elsevier.

Dean, J.W., Jr. and S.A. Snell, (1996). The strategic use of integrated manufacturing: an empirical examination. *Strategic Management Journal*, 17(6), 459-480.

Drury, C., Braund, S., Osborne, P. and Tayles, M. (1993). A survey of management accounting practices in UK manufacturing companies, Chartered Association of Certified Accountants.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18 (1), 39-50.

Gómez,J.,Vargas,P.,(2012).Intangible resources and technology adoption in manufacturing firms. Res.Policy 41(9),1607–1619.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River: Prentice Hall.

Hair, J.F.J., Money, A.H., Samouel, P. and Page, M. (2007). *Research Methods for Business*. U.S: Wiley.

Hayes, A. F. (2013). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. New York, NY: The Guilford Press.

Henry, Gary T. (1990). Practical sampling ([10. Nachdr.] ed.). Newbury Park: Sage Publications. ISBN 0803929587.

Isa, C.R. and S.Y. Foong,(2005). Adoption of advanced manufacturing technology and management accounting practices: the case of manufacturing firms in Malaysia. *World Review of Science, Technology and Sustainable Development*, 2(1): 35-48.

Ismail, K., & Isa, C. R. (2011). The role of management accounting systems in advanced manufacturing environment. *Australian Journal of Basic and Applied Sciences*, 5(9), 2196–2209.

Jaikumar, R., (1986). Postindustrial manufacturing. *Harvard Business Review*, November/December, 69-76.

Johnson, H.T. and R.S. Kaplan, (1987). Relevance lost: the rise and fall of management accounting. Boston: *Harvard Business School Press*.

Jusoh, R. and Parnell, J.A. (2008). Competitive strategy and performance measurement in the Malaysian context. An exploratory study. *Management Decision*, 46(1), 5-31

Kong, T., Feng, T., & Ye, C. (2016). Advanced Manufacturing Technologies and Green Innovation: The Role of Internal Environmental Collaboration. *Sustainability*, 8(10), 1056. https://doi.org/10.3390/su8101056.

Kotha, S. and P.M. Swamidass, (2000) Strategy, advanced manufacturing technology and performance: empirical evidence from U.S. manufacturing firms. *Journal of Operations Management*, 18, 257-277.

Leite, A. A, Fernandes, P. O., & Leite, J. M. (2015). Contingent factors that influence the use of management accounting practices in the Portuguese textile and clothing sector. *The International Journal of Management Science and Information Technology*. Special Issue: Spanish-Portuguese Scientific Management Conference, 59-77.

Lewis, M. W., & Boyer, K. K. (2002). Factors Impacting AMT Implementation: An Integrative and Controlled Study. *Journal of Engineering and Technology Management*, 19(2), 111-130.

Long, J.S. (1997). *Regression Models for Categorical and Limited Independent Variables*. California: Sage.

Marri, H. B., Irani, Z., & Gunasekaran, A. (2007). Advance manufacturing technology implementation in SMEs: a framework of justification criteria. I*nternational Journal of Electronic Business*, 5(2), 124–140.

Mia, L., (1993). The role of MAS information in organizations: An empirical study. *British Accounting Review*, 25, 269-285.

Mia, L. and B. Clarke, (1999). Market competition, management accounting systems and business unit performance. *Management Accounting Research,* 10, 137–158.

Mia, L., (2000). Just-in-time manufacturing, management accounting systems and profitability. *Accounting and Business Research*, 30(2), 137–151.

Mia, L. and L. Winata, (2008). Manufacturing strategy, broad scope MAS information and information and communication technology. *The British Accounting Review*, 40, 182–192.

Nair, S., & Soon Nian, Y. (2017). Factors Affecting Management Accounting Practices in Malaysia. *International Journal of Business and Management*, 12(10), 177. https://doi.org/10.5539/ijbm.v12n10p177

Otley, D.T. (1980). The Contingency Theory of Management Accounting: Achievement and Prognosis. *Accounting, Organizations and Society*, 5(4), 413-428.

Oyewo, B. (2017). Predictors of the Effectiveness of Management Accounting Function in Nigerian Firms. Scientific Annals of Economics and Business, 64(4). https://doi.org/10.1515/saeb-2017-0026

Patiar, A. and L. Mia, (2008). The interactive effect of market competition and use of MAS information on performance: Evidence from the upscale hotels. *Journal of Hospitality and Tourism Research*, 32(2), 209-234.

Patterson, M. G., West, M. A., & Wall, T. D. (2004). Integrated Manufacturing, Empowerment, and Company Performance. *Journal of Organizational Behavior*, 25(5), 641-665.

Percival, J. C., & Cozzarin, B. P. (2010). Complementarities in the implementation of advanced manufacturing technologies. *The Journal of High Technology Management Research*, 21(2), 122–135. https://doi.org/10.1016/j.hitech.2010.05.002

Saunders, M., Lewis, P. and Thornhill, A. (2009). *Research Methods for Business Students*, 5th ed. England: Pearson Education Ltd.

Sillince, J.A.A. and G.M.H. Sykes, (1995). The role of accountants in improving manufacturing technology. *Management Accounting Research*, 6, 103–124.

Sim, K. and L. Killough, (1998). The performance effects of complementarities between manufacturing practices and management accounting systems. *Journal of Management Accounting Research*, 10, 325–346.

Singhry, H. B., Abd Rahman, A., & Imm, N. S. (2016). Effect of advanced manufacturing technology, concurrent engineering of product design, and supply chain performance of manufacturing companies. The International Journal of Advanced Manufacturing Technology, 86(1–4), 663–669. https://doi.org/10.1007/s00170-015-8219-3

Sulaiman, S. and Mitchell, F. (2005). Using a typology of management accounting change: An empirical analysis. *Management Accounting Research*, 16(4), 422-437.

Szychta, A. (2002). The scope of application of management accounting methods in Polish enterprises. *Management Accounting Research*, 13, 401-418.

Thakur LS, Jain VK (2008) Advanced manufacturing techniques and information technology adoption in India: a current perspective and some comparisons. *The International Journal of Advanced Manufacturing Technology* 36:618–631. doi:10.1007/s00170-006-0852-4

Williams, J.J. and A.E. Seaman, (2002). Management Accounting Systems Change and Departmental Performance: The Influence of Managerial Information and Task Uncertainty. *Accounting, Organizations and Society*, 13, 419-445.

Wold, H. (1985). Partial least squares. In S. Kotz, and N. L. Johnson, (Eds.), *Encyclopedia of Statistical Sciences*, Vol. 6 (pp. 581–591). New York: Wiley.

Zhang, Q., Vonderembse, M. A., & Cao, M. (2006). Achieving Flexible Manufacturing Competence. *International Journal of Operations & Production Management*, 26(6), 580-599.