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Human Resource Management Practices Develop Product Differentiation and Cost Leadership Strategy, Enabling Organizations to Attain Competitive Advantage: A Narrative Review

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Abstract

Human resource management practice (HRMP) has been broadly acknowledged and widely recognized by almost every organization. Many studies have been conducted to review the application of human resource management (HRM) and other aspects that have manifested and been determined to be true in a variety of scenarios. HRM practices are essential and effective in the delivery of services and socioeconomic growth. In well-established organizations, up-to-the-level performance and competition are impossible without the required skilled, well-motivated people working in a good human resource management programme development. In both small and big educational institutions, a framework that relies on human resources management strategies for programme implementation is required in an educational setting the most essential practices of human resource management are selection and recruitment, appraisal of performance, training and development and reward remuneration systems. It is very pertinent for an organization to comprehend methods of attracting, retaining boast the Morales of those in the marketplace who are skilled and competent. Organizations by the virtue of implementation of soft dimensions of HRM become able to gain a competitive edge. From the available literature, it is evident that through the procedures and practices of human resource management not only the performances of an organization are enhanced but it becomes able to get what is called "competitive advantage".

Keywords: HRM practices; organizational performance; competitive advantage; educational settings.

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1.   Introduction

Traditional economics has moved to a knowledge-based economy, with employment manifesting as knowledge application; simply put, we are now in the era of the knowledge economy (Awan & Saeed, 2014; Muhammad, 2015). Business practices have changed, with tangible assets accounting for 20% of business assets and intangible assets/intellectual capital accounting for 80% of an organization's assets (Roos et al., 2001). One can easily see how much change has occurred by comparing two eras, i.e. the present and the past. According to Bhasin (2012), in the past, 70% of investments were made in the form of material, and approximately 30% of investments were made for the growth of intellectual capital (IC), which was the training of employees to make them more skilled, but in the last few years, 67 % of investments were allotted for research and development, IT, Education, skills and abilities while 33% of the investments were allocated for tangible assets. These data reveal that the production, measurement, appraisal, and observation of intellectual capital currently requires a great deal of thought. Human resource management (HRM) is viewed as a venture in human capital when employees perform exceptionally well and bring value to their employer's business (Snell & Dean, 1992).

Human resource management is an essential function of administration that regulates the performance of employees in any organization. Human resource management has a critical administrative role that oversees employee performance in any organization. Recruitment, training and development, performance evaluation, pay management, well-being and health, and trade interactions are all HRM practices. While Obeidat and Abdallah (2014) added that job nature activities and teamwork as essential HRM practices. HRM, as a method of dealing with human abilities to fulfill an organization's goals, will necessitate the most effective use of employees (Fong et al., 2011; Gope et al., 2018). Educational Human resource management in the education sector is the process of inspiring people to get the most out of their performance to accomplish exceptional performance even from the day they were inducted, as educational institutes are organizations like any other. This proves that using people to fulfill their jobs and tasks at school is a good idea. This affirms the use of people to perform various activities and roles in the school (Oduma & Ile, 2012).

There has been very extensive literature available regarding the practices of HRM which is based on different types of data; however, the instant study has taken four of the famous human resource technique and practices which include: the process of making selection and recruitment, assessment and appraisal of performance, development and training and system of reward and compensation. It was the enhancement of performance of organizations and efficient delivery of services of an organization that have often been referred in HRM literature became of the reason of justification of the selection of the above said four HRM practices for the current study. Consequently, the current study has given priority and preference to the four practices over others because these four are mainly responsible for the

enhancement of the performance of an organization as well as getting a competitive advantage.

2.   Literature Review

Human Resource Management (HRM) will be more effective in any organization if new information systems are implemented, followed by effective administration and management of these systems for the benefit of other stakeholders (Cegarra-Navarro et al ., 2016; Teymournejad & Shahtaheri, 2019).

For the execution of their plans, all educational institutions are today heavily reliant on human resource management systems. Similarly, Nwaka and Ofojebe (2010) stated that teachers can play an important role in the shaping and implementation of desired classroom objectives. A manager in the private or public sector is well aware that employees are the essential pillars of any organization for accomplishing organizational goals; without them, these organizations will neither be productive nor efficient (Oduma & Ile, 2012). Similarly, these are the teachers who are responsible to make school plans more effective and ensure that the policies mentioned in the school curriculum are implemented. In the end, it is the teacher who evaluates and implements policy (Omojunnwa, 2007). It is simply possible to sustain and humanize educational standards by having teachers work in their particular institutions. As a result, teachers are the most important people in the school. These teachers are the most valuable resource for acquiring knowledge. The ability to teach the curriculum successfully is hampered by a lack of or poor management of instructors. It is critical to remember that efficient human resource management in educational settings can only be achieved if teachers promote the learning process for self-actualization and national growth.

The literature review focuses on two core aspects: human resource management practices and competitive advantage, as well as the potential impact of human resource management practices on competitive advantage in educational settings in Pakistan, a third-world country.

2.1   *Human Resource Management Practices*

This study focuses on four core HRM practices: recruitment and selection, training and development, performance appraisals, compensation and reward, based on the extensive literature available. While the rationale behind selecting these practices is that the aforementioned practices appear frequently in HRM literature for the sake of engineering and service trades know-how.

2.1.1   Recruitment and selection

Most employers agree that their employees are their most valuable asset, thus recruitment and selection methods are vibrant and ensure that a newly recruited employee can become adept and provide desired results in a short period. In a nutshell, an institute's success is influenced by having the right amount of people, as well as having the right skills and talents cited in Obeidat et al. (2019). The process of assessing potential employees and encouraging and motivating them to apply for jobs in a business is known as recruitment and selection (Edwin, 1980). Recruiting, according to Khanna (2014), is defined as the practice of advertising vacancies in any valued capacity most appealingly and equitably possible with the only objective of attracting to the role as many competent people as possible. In contrast, the selection is a way of categorizing the most eligible job applications in order to determine who will be hired or fired as a result of their performance.

However, recruiting and selection are two linked forms; we may say that recruitment is a technique for creating a pool of talented people to apply for jobs in a business, whereas willpower is the process of applying certain procedures to select the most equitable applicant for work (Gold & Bratton, 2003). Furthermore, before the recruitment and selection process, an advertisement may be prepared for the announcement of vacancies based on job descriptions; following that, the position that has been widely advertised attracts a large number of candidates, and then the scrutiny begins for shortlisting candidates and identifying them through validated trials and interviews (Adetunji, 2015). Methods of recruiting individuals can be divided into two categories i.e. internal and external.Present employees and employee recommendations make the internal units of recruitment whereas external elements of recruitment include professional associations, printed announcements, unsolicited candidates, referring organizations, and the use of the internet/ Facebook/websites in the internal method of recruitment (Absar, 2012). A number of selecting approaches may include difficult procedures, while others may place a greater emphasis on conducted interviews and the use of credible sources (Tabassum, 2011).

Human resource professionals understand how to locate and pick the best employee through the selection process, as well as how to keep the most qualified and capable employee. They also have access to critical information that aids in the decision-making process (Longenecker & Fink, 2013). A high level of commitment can be achieved as a result of effective recruitment and selection. Activities related to human resource management (HRM); if carried out properly, these activities can have a substantial impact on institutional performance, hence contributing to a more pleasant organizational image (Pilbeam & Corbridge, 2006). Caldwell et al. (1990) studied 291 employees from 45 organizations and discovered that rigorous recruitment and meticulous selection led to a high level of organizational commitment (Whitener, 2001). Even if the candidates are in danger of losing a potentially crucial representative, philosophical quality to them may give the sense of genuineness (Meyer &

Allen, 1997). Clear induction, suitable applicants, and selecting candidates are the three steps in the recruitment and selection process (Armstrong, 2001). The better the job, enthusiasm, effective results, and impassioned workforces are, the more impartial induction and selection procedures and protocols are used in organizations (Rioux & Bernthal, 1999). This results in slight variations in the selection process from one institute to the next. The following steps, however, are generally followed: completion of application forms, preliminary tests (including on-paper examinations), broad interviews (including reference checks), and finally an offer of employment (Absar, 2012).

2.1.2   *Training and Development*

Training and development are primarily focused on obtaining an understanding of how the organization's strategies, methodologies, and practices are implemented. Training and development is the most important practice in human resource management; it improves the job setting and employee performance, promotes mutual respect, and advances the institute's level (Ahmad et al., 2014). In the training and development process, there are five steps: first, understanding the worker's abilities, profession-based performance skills required for the position, and second, instructional strategy, which describes how the training programmed element is determined, carefully chosen, and intended. While there will be another level of validation, at this step, the defects in the training package are identified and divorced from it by handing it over to a less representative community. Similarly, the provision of training to the targeted workforce team is advised as the fourth step of implementation. Finally, in the fifth phase which is an evaluation, the administration analyses the program's achievements and failures (Obeidat et al., 2019).

According to the little page, a variety ranges of training and development methods are available, which can be divided into three categories: cognitive improvement techniques, behavioral change approaches, and managerial improvement approaches. Cognitive methods, which might contain printed or verbal information as well as visual representations of connections between ideas, are used to determine how to do any task successfully. They are connected with changes in knowledge and confidence as a result of stimulating education, whereas behavioral techniques are related to giving trainees hands-on experience and allowing them to participate in an actual real-world situation.

These techniques and methods are extremely effective when employed to develop someone's talents. Finally, administration development strategies are a well-thought-out and forward-thinking approach. And there's a big emphasis on employee learning. Exercise and comprehension training is included in a lot of these strategies.

Training and development play a critical role in keeping businesses and government organizations operating and gaining a competitive advantage in their circles, as well as achieving the best results because training and development programmed improve workers' skills, which leads to increased employee productivity (Chaudhary & Bhaskar, 2016). It is critical in the commercial sector and government institutions to maintain and support individual employees in learning first-hand experience and information in order to increase their presentation skills and understanding of various organizations (Joardera et al., 2011). Furthermore, define training and development as a set of competencies, methodologies, and pieces that come together to form a consistent strategy that is driven by the organization's desire to increase the capabilities of its employees. These training and improvements are very beneficial in terms of developing staff competencies as well as enhancing networking, experiences, and learning through social capital (Choo & Bowley, 2007).

Training is essential for organizational growth since it enhances employees' knowledge, such as technical, abstract, and administrative abilities, and these skills aid individual success in institutes (Kulkarni, 2013). Training and development have a positive influence on creating relationships between managers and coworkers in the institute, resulting in a productive working environment (Vuta & Farcas, 2015). Training and development improve individual abilities and increase job satisfaction among employees, resulting in raises in pay, promotions, and incentives (Chaudhary & Bhaskar, 2016). They went on to say that if a company wants to compete in the market, it needs to have a comprehensive employee development programme in place. Because good training and development improve organizational performance, employee excitement, satisfaction, and responsibility (Lashley, 2002).

2.1.3   *Performance Appraisal*

Performance appraisal is an occasional but formal system by which workers are assessed by organizations is that supervisors assess workers' performance based on already set goals and aims and assign a score based on their appraisal (DeNisi & Murphy, 2017). According to Mondy and Noe (2005), performance appraisal is a technique for identifying, measuring, appraising, improving, uplifting and compensating individuals for their contributions to organizations. The organization's main focus is on performance appraisal, which is beneficial in developing the organization, identifying potential workers, and assessing employee performance, all of which are required for the organization's prosperity and uplift (Lau et al., 2008). Performance appraisals track how well and how much individuals complete job-related tasks and they aid in identifying the most capable workers (Ishizaka & Pereira, 2016). Performance appraisal is becoming increasingly used as a tool for efficiently managing and improving employee performance (Buchner, 2007; Selvarajan et al., 2018).

The goal of performance appraisal is to motivate people to improve and develop their performance in the workplace (DeNisi & Pritchard, 2006; Selvarajan et al., 2018). Performance appraisal is thought to be especially important for motivating, encouraging, and developing the highly competent knowledge personnel needed for a successful and competitive education sector (Gu & Nolan, 2017). When compensation and awards are conditional on performance, performance appraisal helps people to learn and enhance their abilities as well as achieve their aims, goals, and objectives (Ma et al., 2017).

According to Mondy and Noe (2005), performance appraisal is a technique for identifying, measuring, appraising, improving, uplifting and compensating individuals for their accomplishments in the workplace. The organization's key consideration is performance appraisal, which is beneficial in strengthening the organization, identifying potential workers, and assessing employee performance, all of which are important for the company's prosperity and uplift (Lau et al., 2008). Fair and honest employee evaluation based on the logical principle of performance can excite employees in the organization and increase their expectations to stay with the company, which will have a direct impact on the company's performance and achievements.

2.1.4   *Compensation and Rewards*

Compensation is a component of HRM practices in which organizations provide some type of reward based on an individual, workgroup, and long-term performance (Jimenez Jimenez & Sanz Valle, 2013). Compensation is defined as remuneration received by a worker in exchange for his or her services to the organization, and it is considered an integral part of human resource management. It is obtained through both financial and non-financial benefits that aid in motivating employees and humanizing the organization's usefulness.

Organizations that, under all circumstances, compensate employees based on their job-related performance (Alkahtani, 2015). Employees in the organization are compensated based on relevant input on resources invested, recommendations, and pay performance size compensations (Noe et al., 2015).

2.3   *Competitive Advantage*

Reserchers, Yaseen et al. (2016) established that when an organization has a competitive advantage it stands in a high position in comparison to other organizations in terms of outcomes. In competitive advantage, an organization produces something valuable but something which is unusual and its production is difficult for other competitors; in addition to this, the superiority of human resource further enhance the growth of the organization (Tiwari & Saxena, 2012).

Performance evaluation, payment, selection procedures, service security, job metaphors, career opportunities, and preparation and development procedures are all examples of HRM practices that can be used to inform employees about the necessary skills and attitudes to produce and maintain a competitive advantage (Adil, 2015). As a result of well-managed human resources, HRM has the potential to be a source of sustainable competitive advantage. It will have an impact on fundamental objectives such as quality, revenue, and customer satisfaction (Absar, 2012). Furthermore, HRM techniques can be utilized to enhance a company's skills and introduce organizational knowledge, resulting in the possibility of sustaining a competitive advantage (Lazim et al., 2015).

Similarly, cited in Obeidat et al. (2019), state a competitive advantage is fundamental for satisfied customers who want a better standard on newly launched products in order to earn a higher revenue compared to the value suggested by the owners to the management; such proposals can be achieved through production organization, increased application, and bringing products to the market; A value-creating strategy that is not forced by their competitors, or the use of tactics that have previously been employed by competitors, but done in a more sophisticated manner, are two ways to achieve this objective. In addition to building bad internal and external business ties, variables that provide a competitive advantage are responsible for developing a reputation for manufacturing exceptional products (Sachitra & Chong, 2016).

2.4   Strategies for Competitive advantage

Two main strategies mainly focus on competitive advantage. These strategies are differentiation and cost leadership.

2.4.1   Differentiation Strategy

Customers are mentally prepared to pay a greater price for manufactured items if they find them to be distinct from other products on the market. The distinction could be in the form of better service, higher quality, or a unique feature. Differentiation strategies are frequently established based on various characteristics, such as item quality, expertise, novelty, trustworthiness, brand image, company reputation, stability, and customer convenience. When using a realistic approach, competitors will find it extremely difficult to replicate (Acquaah, 2011).

2.4.2   Cost Leadership

The cost leadership policy has a procedure for manufacturing products or refers to those facilities which are attractive to the customers for having low cost compared with other competitors (Obeidat et al., 2019). According to Tanwar (2013), technological revolutions

that wipe out previous investments and outdated earlier knowledge, imitation by late competitors who benefit from the low-cost culture, a lack of consideration for clients' needs and inclinations due to excessive cost-cutting concerns, and unexpected price increases are some of the threats that cost leadership is vulnerable to.

2.5 *Human Resource Management Practices and Competitive Advantage*

Although the most significant prerequisites for gaining a competitive advantage are production capabilities, research test centers, right of entry to economic resources, supply networks, or large-scale cost-cutting. In today's business world, however, these are insufficient for success. However, only human capacity is highly valued because it has the capability of learning new knowledge, propagating it, and making a contribution in the current world market; all other forms of assets are merely seen as entities that can be purchased easily at market rates. It is an only human ability that is highly regarded because it has the capability to gain new knowledge while also spreading and contributing (Coff & Kryscynski, 2011).

3. Methodology

Keeping in view the vital role of the HRM practices in boosting the performance of the organizations' several research papers were downloaded from different databases, especially with reference to educational institutes. These papers are thoroughly examined, consequently, theoretical and conceptual frameworks developed to proceed and conclude this comprehensive study. Hypothesis arrayed to justify and verify the theoretical and conceptual frameworks in light of existing discussions and conclusions of selected studies.

This study is delimited to the four pivotal practices of the HRM namely: 1) Selection and Recruitment, 2) Training and development, 3) Appraisal System, 4) Reward and Compensation.

3.1 *Theoretical Framework*

Human resource management (HRM) is a broad term that refers to managing institutional employees through proper strategic resource management, acquiring competitive advantages, and creating more value than other organizations (Obeidat et al., 2019). Human resource management includes policies, procedures, processes, and practices that influence employee behavior, skills, and productivity. Cited in Obeidat et al. (2019), found that high-value HRM strategies such as appropriate recruiting, training, performance evaluation, and remuneration had a positive impact on innovation.

HRM practices in a well-organized company will be responsible for achieving competitive advantage through the use of cost leadership phenomena and the implementation of a product differentiation strategy. As a result, according to Shouman and Othman (2016), Differentiation tactics are exclusively based on supplying customers with something distinctive or different that distinguishes the company's product or company's service from those of competitors. All and above cost leadership of an institution can be found in its ability to make available products/ services which are not only cheaper but also has quality when compared to the other such competitors (Aziz & Samad, 2016).

Human resource management is widely regarded as the most essential factor in increasing the efficiency of an organization and so gaining a competitive advantage in the marketplace (Obeidat & Abdallah, 2014). Competitive advantage refers to a group of abilities that allows an organization to generate higher-quality work than its competitors, whereas "competitive advantage" refers to a set of talents that enable an organization to produce higher-quality work than its competitors (Bobillo et al., 2010). Because of this, businesses can only gain a competitive advantage by offering the same profits as their competitors but at lower prices, thereby providing customers with an economic benefit; similarly, they can gain an advantage by providing benefits that exceed those of competing items, demonstrating a differentiation advantage to customers (Obeidat et al., 2019).
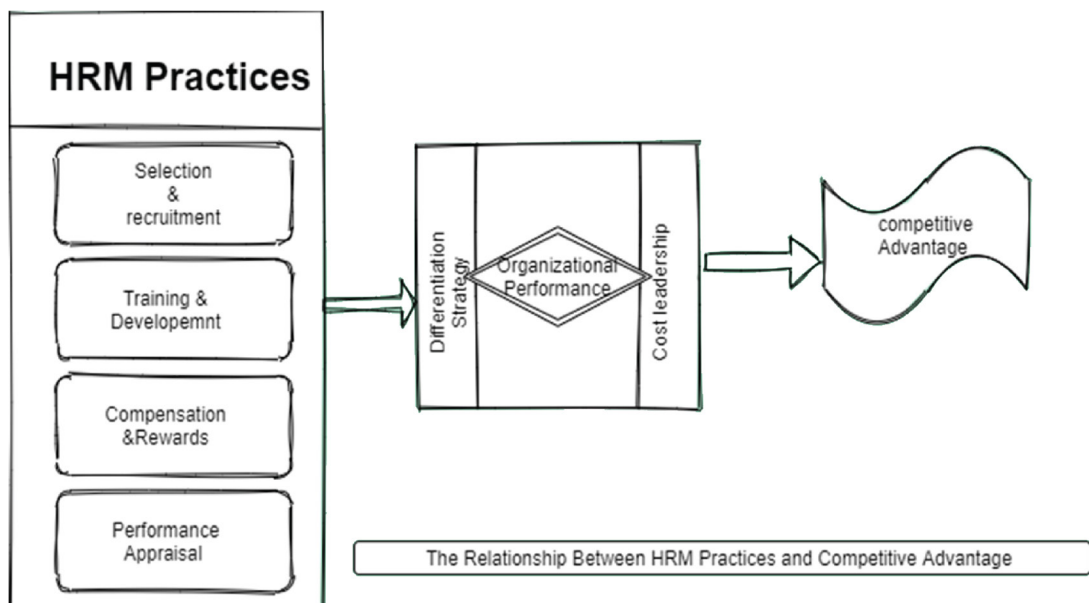
3.2   *Conceptual Framework*

Figure 1: Conceptual Framework

3.3   *Hypotheses*

H1: Selection and recruitment practices significantly affect organizational performance.
H2: There is a significant relationship between training and development practices and organizational performance.
H3: Compensation and rewards significantly enhance organizational performance.
H4: The performance appraisal system of an organization improves its performance.
H5: There is a strong relationship between organizational performance and competitive advantage.

4.   Discussion

Available literature responds to the first hypothesis (H1), Khanna (2014) articulated that staffing is the process of announcing through print or electronic media that certain vacant positions are available and offering a generous package to the most qualified and talented candidates with valuable skills, whereas selection is the process of reviewing applications after they have been submitted for the advertised jobs and then scrutinized. Most organizations believe that their employees are their most precious asset; as a result of this, enlistment and selection procedures are critical in ensuring that a newly employed employee can become productive and achieve the required outcomes in a short period of time after being hired. Recruitment and selection are two intertwined concepts: recruitment is the process of selecting a group of qualified individuals to apply for work with a company, and selection is the tool by which certain procedures are used to select the most suitable applicant for the job (Gold & Bratton, 2003).

There are three distinct parts in the recruitment and selection process: identifying recruiting requirements, enticing prospects, and selecting aspirants (or candidates for hire) (Armstrong, 2001). Recruitment and selection procedures typically begin with the publication of a job advertisement that is based on job investigative process and job description of a vacant position; following that, the position is advertised widespread in order to gain a maximum number of applicants; and finally, the most eligible applicant is chosen through authentication mechanism trials and interviews (Adetunji, 2015). It is possible to divide recruitment methods into two categories: internal and external recruitment methods). Existing employees and employee referrals are among the members of the internal recruitment team; expert associations, printed advertisements, unsolicited candidates, management referring companies, and the company's website are among the members of the external recruiting team (Absar, 2012). A number of selection processes may include testing measures, while others may place a greater focus on interviews and the recommendations of some industry experts (Tabassum, 2011). The success of a company can be influenced by having the appropriate amount of employees with the appropriate skills and aptitudes on hand). In an organization, recruitment and selection is the process of scouting for potential employees and encouraging and inspiring them to apply for positions within the organization (Edwin, 1980).

As mentioned in the research study conducted by Caldwell et al. (1990), it is possible to acquire a high degree of commitment by following effective recruitment and selection procedures. A total of 291 employees from 45 companies participated in the study, and the researchers discovered that rigorous recruitment and careful selection processes resulted in a high level of organizational commitment (Whitener, 2001). Even if the candidates are in danger of losing a potentially crucial representative, the philosophical quality of the candidates might create an image of genuineness (Meyer & Allen, 1997). Employees' performance, motivation, effective results, and passion will all improve when institutions have fair recruiting and selection policies and regulations in place, according to research (Rioux & Bernthal, 1999).

A key reason why human investigation leaders are so successful in their work is that they understand how to attract, select, and retain top talent in an elegant manner. At regular intervals, they also keep themselves updated on critical issues, such as the correct number of people and roles in their offices, as well as the status of their projects (Longenecker & Fink, 2013). Recruiting and selection work together to form the foundation of human resource management accomplishments; if these activities are completed successfully, they can have a significant impact on organizational achievements, thereby contributing to the formation of a more positive institutional image (Pilbeam & Corbridge, 2006). As a result, Pilbeam and Corbridge (2006) provided a useful outline of possible positive and negative characteristics, stating that: The process of recruitment and selection of employees is critical to the operation of a business, and there are several compelling reasons for conducting it accurately. Mistaken selection decisions impair the organizational performance, because remuneration and development plans to be thrown off track, are frequently unjust, especially to newcomers, and can be stressful for managers who are forced to work with inappropriate employees.

4.1   *Second hypothesis (H2) can be cleared from the existing literature such that*

Training and development are primarily concerned with the achievement of an understanding of how strategies, processes, and practices are implemented in organizations, which is referred to as organizational understanding. Training and development is the most important practice in human resource management since it helps to make the workplace more productive and increases the performance of individuals while also promoting mutual respect and raising the overall level of the business (Ahmad et al., 2014).

Because training and development packages increase staff skills, which in turn increases team performance in the firms, the role of training and development is extremely important in all types of businesses, educational institutions, and public organizations in order to keep organizations successful and achieve competitive advantage and further to get the best outcomes. Training and development packages increase staff skills, which in turn increases team performance in the firms (Chaudhary & Bhaskar, 2016). In the worlds of

commercial and public organizations, it is critical to assist and enable the individual employee in becoming aware of new capabilities, familiarize themselves with objectives, and expand their existing skills and knowledge in order to further their careers (Joardera et al., 2011). explain that training and development is a collection of techniques and approaches that are rewarded in order to establish a purposeful attitude that is adopted by the firm's efforts to improve the know-how of its employees, which they define as follows: The benefits of training and development go beyond simply enhancing an employee's knowledge; they also involve the chance to connect with and learn from people who come from a variety of different backgrounds and experiences (Imran & Tanveer, 2015).

Training builds competencies among employees, such as technical, conceptual, and management abilities, which are necessary for organizational success. These competencies aid in the improvement of individual performance in the organization (Kulkarni, 2013). Training and development also help to strengthen the bonds that exist between managers and their employees, which helps to establish a productive working environment in the firm (Vuta & Farcas, 2015). Individual skills and high levels of job satisfaction are enhanced through training and development, and as a result, increases in salary, promotions, and incentives are realized by employees (Chaudhary & Bhaskar, 2016). Found that training and development boost the productivity of a company. They went on to say that organizations that want to compete in the marketplace must set up employee development programmes within their own organizations. Training and development that is effective improve organizational performance, employee motivations, employee satisfaction, and staff commitment (Lashley, 2002). Learning new technology and skills allows small firms to grow into large enterprises by educating their existing employees as well as newly hired employees, and by utilizing innovative technologies, small businesses may thrive in a competitive environment. To summarize, training can boost the productivity and inspiration of employees, resulting in an increase in both productions and work satisfaction for the organization (Alaraqi, 2017).

4.2   Third hypothesis (H3) are responded through certain studies

Chaudhry (2011) went on to say that organizations' incentive systems improve the performance and concentration of their employees and that when a company improves the performance of an employee in an impartial manner, the organization's effectiveness and efficiency are increased as a result. However, according to Frye (2004), rewards are lifelong motivations that authenticate employee perceptions. Furthermore, human capital is the most important significant benefit for any organization's performance, and the damage done to valuable human capital as a result of deprivation of inducements may be extremely costly to the company. It was also stated that there is a positive relationship between skills and experience-based compensation and the performance of a business. It aids in enhancing the motivation of high-skilled employees, as well as attracting and retaining them. Inclusion in the category of compensation and rewards benefits are all forms of payment and prizes such

as bonuses, commissions, leaves of absence, appreciation programmes, flexible work hours, and medical protection (Sherman & Snell, 1998). While investigated the intrinsic and extrinsic payment instruments in the education sector of Pakistan and found that compensation has an organizationally positive relationship with motivation; increases worker spirit and maintenance; increases representative commitment; and increases profitability. Furthermore, compensation can help to stabilize and retain people, as well as to reduce employee turnover within a company (Odunlami & Matthew, 2014).

Because of this, the institute's reward system should be an effective instrument for fostering desired employee behavior and a positive mood throughout the organization (Beck-Krala & Scott, 2014). In contrast to this, Delery and Doty (1996) found that performance-based compensation was the only reliable predictor of a company's performance. Similarly, Paul and Anantharaman (2003) pointed out that the compensation arrangement has a direct impact on the employee's ability to accomplish their job duties. For the avoidance of doubt, reward and compensation policies must be considered vital to the achievement of company objectives.

4.3   *Fourth hypothesis (H4) well explained in literature invaluable words*

In businesses, performance appraisal is a formal system through which employees are evaluated. Supervisors analyze employees' performance in accordance with a predetermined set of objectives and goals, and they then assign a score to the employee based on their evaluation (DeNisi & Murphy, 2017). It measures how well and to what extent individuals perform in the performance of job-related activities and tasks, and it aids in the identification of the more competent employees (Ishizaka & Pereira, 2016). In recent years, performance appraisal has become more recognized as a tool for efficiently managing and improving employees' performance (Buchner, 2007, Selvarajan et al., 2018).

The purpose of performance appraisal is to stimulate employees so that they can ultimately improve and develop their performance in their respective workplaces (DeNisi & Pritchard, 2006; Selvarajan et al., 2018). Performance evaluation is seen as particularly important for the inspiration, encouragement, and improvement of highly skilled knowledge, and employees will require an effective as well as competitive evaluation system in educational settings to be effective and competitive in their jobs (Gu & Nolan, 2017). Compensation and rewards based on performance encourage employees to develop and enhance their abilities as well as to achieve their aims, goals, and objectives when compensation and awards are conditional on performance (which is the case in most organizations) (Ma et al., 2017). The performance view offers significant potential for increasing the value of employees based on their individual and collective performance. On top of all this, highly valued employee performance appraisal and reporting lead to a boost in employee engagement, inspiration, and job fulfilment. The objectives of performance reporting are to increase individual and

group performance while also assuring employee commitment, excitement, and enjoyment in the workplace (Aguinis, 2009). Employee working behaviour can be transformed through performance review and reporting, which also improves job satisfaction and working circumstances for the employees involved (Islam & bin Mohd Rasad, 2006). There is a dire need for an effective performance appraisal system for the effective functioning of any organization (Alaraqi, 2017).

H5: *There is a strong relationship between organizational performance and competitive advantage.*

The competitive advantage gained through human resource management strategies may be more sustainable than the advantage gained through other means. As a result, a company's human resource management methods need to be regularly improved in order to maintain its competitive advantage. In order to ensure that the provision of skilled and competent persons, as well as the competencies of existing employees, are aligned with the company's current and upcoming business strategies, the division of human capital is motivated to achieve this milestone. This will allow the company to take full advantage of profit on financing, understanding, close monitoring and digital systems (Obeidat et al., 2019).

The most effective human resource management strategy Firstly, organizations provide internal career opportunities as well as proper recruitment and selection of employees; second, organizations provide a wide range of training opportunities for their employees; third, performance appraisals are hypothesized on the basis of outcome performance evaluations and the extent to which subordinates are taken into consideration in these evaluations; fourth, generous incentives and reimbursements are provided to workers in exchange for motivation, desirableness, and reducing turnover; and fifth, workers are encouraged to participate in company activities (Akhtar et al., 2008). Differentiation and cost leadership strategies are two of the most widely recognized programmes that place a strong emphasis on achieving competitive advantage.

It has been discovered that clients of differentiated items are less sensitive to rate changes, which is one of the advantages of the differentiation strategy. Another advantage is that these strategies are built on the foundation of exceptional quality, which in turn increases the potential market share that a company might earn in the future. In addition, items that are incredibly popular and trustworthy make it harder for new rivals to enter into competition with the surviving firms that already hold these qualities (Altaf & Khalil, 2016).

When it comes to companies that successfully follow cost leadership, Hilman and Kaliappen (2014) identified six key cost benefits or ways of gaining cost advantages. These include size variances and cost-cutting of scale, high volume utilization, knowledge differences and learning-curve financial prudence, differential low-cost entry to fruitful inputs and technological benefits that are independent of scale, as well as policy adoptions.

4.4   Conclusion

The impact of human resource management practices on competitive advantage has a direct correlation to the organization. Previous empirical research investigated the relationship between human resource management strategies and acquiring a competitive edge (Bhattacharjee & Bhattacharjee, 2015; Takeuchi et al., 2003; Waiganjo et al., 2012). Among other things, human resource management has the potential to be a source of long-term competitive advantage, and it would have an impact on primary objectives such as excellence, yields, and customers satisfaction (Absar, 2012). As a result, human resource management (HRM) is critical for attaining competitive advantages in education (Usrof & Elmorsey, 2016). Continuous changes are taking place around the world in educational settings, and these changes have a significant impact on the long-term stability of institutions. As a result, businesses must employ a variety of strategies, either directly or indirectly, to manage and address the changes that threaten their existence in order to remain viable (Teymournejad & Shahtaheri, 2019).

The emergence of new knowledge and awareness has prompted competition between educational institutions. Consider human resource management (HRM) as a change strategy, which is the most significant function that it can play in an organization's success (Teymournejad & Shahtaheri, 2019). Navarro-Gómez and Rueda-Narvaez (2015) argue that human resource management (HRM) might be the most significant changing element in an organization by bringing in new information into the system from one side and successfully managing that information from the other. This simply indicates that when pedagogues in the educational settings are effectively recruited, selected and directed, inducted and sufficiently compensated, and provided for, appropriately developed, assessed and promoted to the next rank, they will be found committed to their jobs, will remain devoted and will be creative in the education systems (Omebe, 2014).

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Examining the Behavior in Public Good Games: An Application of Prisoner's Dilemma

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Abstract

   This study is an attempt to mimic a real-life scenario in which individuals have a choice to opt between personal benefits and communal benefits. The purpose of the study is to analyze the patterns in charitable giving under different scenarios, i.e., as an individual and as a member of a social group. The study employs a modified version of the standard "Public Good Game"; it offers novelty in terms of the addition of the role of social pressure on charitable giving. The study dichotomized the game design into two settings: the first one was when an individual was made to play the game and contributions were anonymous, while the second set was the case when group size was fixed, and intragroup communication was allowed. The magnitude of contributions was significantly lower in solo settings as compared to group settings. As the game progressed, contributions toward public goods decreased in solo settings, while an opposite pattern was observed in group settings. Results show that wherein free ridership is not a dominant strategy, its presence further weakens with the introduction of social pressure. The uniqueness of the current study lies in the fact that the game design used in this study reflects an interdisciplinary perspective encompassing sociology, psychology, and economics.

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1.   Introduction

Human decision-making has two distinct systems: system I, which makes split-second decisions in emergencies, and system II, which is reserved for situations that require the complex and thoughtful activity of the human brain. Closely linked with the idea of irrationality is the idea of free ridership in group behaviour; the "free-rider hypothesis" (FRH) is the belief that some individuals in a population will tend to consume more than their fair share of a common resource, or that they will pay less than their fair share of the cost of the common resource (Stein et al., 2021). The FRH purports to explain the inability of rational economic agents to set aside their self-interested motivations in the face of mutually beneficial gain. This problem has cropped up under various headings in several different disciplines of social science, but what it ultimately comes down to is the problem of collective action.

The collective action problem refers to a situation where two or more agents face two courses of action: coordination or defection. Defecting is believed to be the individually rationalistic option i.e. if the individual chooses to defect, he can expect to maximize his returns. However, joint coordination of actions can result in greater gains that are mutual to all. Coordination is the socially optimal option; however, it is not rationally individualistic because of the lower private returns it offers and this causes conflict to arise. The conflict is primarily between individual and group interests, and it leads to a collective failure that is termed the collective action problem. Thus, the collective action problem can be summed up as the failure to achieve the outcome everyone would prefer over the outcome. This is because each individual prefers to enjoy the benefits of a socially optimal result without having to endure the costs of it; the resultant overall situation is, consequently, one that is socially inferior. The lack of interest in participation in collective action problems often leads to free ridership; once provided, the good is available to all regardless of their participation. The problem of collective action was best illustrated by Olsen (1965). Before that, the consensus was that there was a natural tendency for people with shared interests to come together in the pursuit of those interests, i.e., there was an unproblematic convergence between individual and group interests, with which Olsen (1965) disagreed.

Today, the FRH can be divided between two approaches: one purported by Samuelson (1954) and the other by Brubaker (1975). Samuelson (1954) provided the weak version of the FRH where sub-optimal provision will occur; Even if some members contribute towards the good because of their interests, there will be members present that free ride off others' contributions. Brubaker (1975) provided the strong FRH: under ideal-typical conditions, no agent should be contributing towards the provision of the public good, i.e., the total contribution by the group should be zero. The conflict an individual face is similar to that illustrated in the prisoner dilemma game; regardless of others' behaviour, the individual is better off not contributing, but if everyone behaves in such a manner, all are made worse off. This scenario has been termed the "Tragedy of the Commons" by researchers (Almeida et

al., 2020; Wilson et al., 2020). The tragedy of the commons implies that generally, people are motivated to work for personal gains more than the communal gains. Hence, in a situation where benefits can be mutually dispersed among all, theory frequently highlights the individual's tendency to contribute as little as possible – and in the process diminish the benefits not only for himself but the entire group he belongs to (Wilson et al., 2020). Proponents of the "Tragedy of the Commons" and the FRH argue that people can reap the benefits of the public good without contributing to it, so non-cooperation is the dominant strategy (Schreck et al., 2019). Yet at the same time, more contributions to the public good would collectively yield a greater payoff to all, so in such a case, individual self-interest is at odds with the combined interest of the group (Ledyard et al., 2020).

Despite economic theory frequently asserting free ridership as a dominating phenomenon in the public good provision, experimental work has questioned this assertion. The most influential paper on this topic (Marwell & Ames, 1979) found that tests of the hypotheses derived more or less directly from the economic theory showed a very weak free-rider hypothesis. Around 57% of available resources endowed to participants were found to be invested in the public good. Ironically enough, the strongest support for the free-rider hypothesis emerged when participants were economists themselves suggesting that such behaviour could very well be learnt rather than naturally occurring. Furthermore, free-rider tendency was shown to be situational, with a significant lack of free-rider problems in the voluntary provision of public goods when any of the "invalidating factors" were present (Kim & Walker, 1984). Moreover, voluntary contributions to public goods can be increased if a stochastic funding policy is followed by the central authority (Huck & Kubler, 2000). Later research was able to expand and move beyond free riding to include the intricacies of human behaviour.

Experiments showed that marginal per capita returns to an individual could play a more impactful role regarding free-riding behaviour as opposed to group size (Issac et al., 1994, Carpenter, 2007), and that familiarity between contributors could encourage contributions (Keser & Winden, 2000). Increases in group size failed to aggravate free ridership; thus, going against conventional wisdom (Lipford, 1995; Haan & Kooreman, 2002). There is strong evidence for the role conditional cooperation plays in determining contribution rates, with papers going so far as to identify a "type" of an agent who models his contributions based on the contributions of others (Frey & Meier, 2004).

The novelty of the current study lies in the fact that it takes an interdisciplinary perspective by employing ideas from sociology, psychology, and economics. It aims to delineate the intricacies of human behaviour with an angle on how social influences can play a role in determining contribution rates. This paper attempts to examine how well economic theory translates into reality via a public good game. Specifically, the research objective of the current study are as follows:

[1]   To determine the individual's willingness to pay for public goods; to check the presence of free ridership after implementing social pressure.

[2]   To compare the willingness to pay for public goods across two settings: with social pressure and without it.

2.   Literature Review

Several studies show how social pressure does, in one way or another, affect an individual's behaviour. People want others to perceive them as fair (Andreoni & Bernheim, 2009). Therefore, they are more generous towards in-group members (Chen & Li, 2009). Generosity and giving behaviour in the face of social pressure, surprisingly, leads to people feeling more positively perceived by others, which influences their perception of themselves.

Social desirability is also relevant in the context of public good games (Fleming & Zizzo, 2011). Social influences can affect an individual's willingness to contribute towards public goods (Carman, 2003). When an individual is assured that his actions will be unobservable, he chooses to act in a manner that is optimal (yields maximum utility) and utilizes the full information available to him. However, when his behaviour becomes observable, he distorts it in order to improve other's perception of him. This increases the contribution to public goods, but at the expense of the giver's disutility and an increased social cost (Daughety & Rainganum, 2010). On the other hand, total contributions may also increase under social pressure with the intention of equalizing income redistribution.

Social pressure has been seen as an impactful way of motivating peers towards more pro-social behaviour, as individuals who are unwilling to contribute to door-to-door campaigns would avoid saying no because of social pressure (DellVigna et al., 2012). Hanes (2012) highlighted a telling trend: there was a noticeable rise in volunteer work among the younger generation. Despite many influencing factors, the study could single out influence from the behaviour of one's colleagues as particularly prominent, i.e., 75.9% of those who volunteered had friends that were involved in social work. Podjed (2014) analyzed the same impact through a different perspective and looked at how observation, either by a friend or an acquaintance, could affect an individual's driving habits. Furthermore, not only external but also self-surveillance had a significant impact on an individual's habits. Such initiatives have illustrated the many ways social influences can impact individual behaviour and how harnessing such a motivator can induce cooperative pro-social behaviour. An example of such an initiative is the 'Ice Bucket Challenge. The challenge was a way to collect donations for the Amyotrophic Lateral Sclerosis (ALS) Association and involved dumping a bucket of ice water over one's head or giving $100 to the association. Interestingly, people not only dumped water on their heads but would also willingly donate.

Various factors, like gender differences, status-seeking motives, envy, and even age differences, once compounded with social pressure, could affect the degree of willingness to pay. However, it was observed that social influences at a personal level have a greater effect on behaviour and charitable giving as opposed to impersonal methods such as television ads (Long, 1976). Besides these factors, group identity can also impact social preferences and thus affect social welfare maximization. There exists strong evidence of linkages between-group favouritism and the extent of charity (Chen & Li, 2009). Thus, as a potent inducer of cooperative, pro-social behaviour, researchers have relied on controlled environments to ascertain more precisely the effect social pressure can have on an individual's willingness to pay, and that the experimental studies have a greater capacity to shed light on free-rider tendencies than other empirical methods (McCaleb & Wagner, 1985). Though the literature is extensive, donations to charities/fundraisers have been used as a proxy for an individual's willingness to pay for public goods, and social pressure has been incorporated into experiments in a variety of ways, including through pins signalling support for a charity (Kessler, 2011) or more overt behaviour such as verbal solicitation (Andreoni et al., 2017). Generally, the findings indicate a strong positive link between the presence of social pressure and charitable conduct.

Literature review allowed us to understand that practical tests of the free-rider problem have shown that, at the very least, there is little support for the problem's existence unless experiments have been aided by some facilitating constraints. Human behaviour is dynamic enough in nature to not be as simplistically explained away as economic theory has done. Behaviour is actually peppered with nuances and has a tendency to vary from theory. Meanwhile, the impact of pressurizing tactics has been seen to have a significant influence. Observation, as well as experimentation, has illustrated that though the direction of the results may not be predictable, social pressure is indeed a motivating factor; and when correctly harnessed, it can assist in bringing about desirable results.

3.   Methodology

3.1   *Theoretical Framework*

The theoretical model was conceptualized by Olson (1965). This study assumes that a group is made up of N number of individuals; where each individual possesses the capacity to produce a non-negative amount of a collective good. Hence, i $\square$ N where the ith individual's contribution is characterized as $\delta \geq 0$. The summation of all agents contributions will result in the total amount of the collective good available for consumption, $\tau = \Sigma_i \; \delta_i$. Each agent gains utility from consuming the collective good – $\mu_i (\tau)$ where $\mu_i' > 0$ and $\mu_i'' \leq 0$ - so implicitly, the group's utility is a result of summation of all individual utilities i.e. $\mu(\tau) = \Sigma_i \; \mu_i(\tau)$. Each agent also incurs a cost from contributing to the production of the good; $c_i (\delta_i)$ where $c' > 0$ and $c_i'' > 0$. Hence, we arrive at the maximization problem:

$$\text{Max } \mu_i(\tau) - C_i(\delta_i) = \mu_i\,(\delta_i + \Sigma_{i \neq j}\,\delta_j) - c(\delta_i) \tag{1}$$

Where the individual will only contribute if $\mu_i(\tau) > C_i(\delta_i)$ and it is assumed that the individual will produce the collective good up till the point that MU = MC. However, each individual values the collective good differently. And no individual takes into account the impact their production capability has on the utility of others in the group. This leads to a sub-optimal amount of the group being produced. What distinguishes Olson's illustration is first, the identification of collective goods possessing a public good characteristic and hence highlighting how prevalent the free-rider problem is in one's society. Secondly, an important result is an impact that group size may have on the provision of the collective good: as the group grows, undersupply of the good is believed to be inevitable.

Hardin (1971) identified the strategic structure of the collective action as the N-prisoner dilemma game where if N > 2 collective actions are essentially assumed to be similar to a large number exchange model. Since each member needs to exchange efforts/resources in order to benefit from the collective provision, there is room for individuals to free-ride off others contributions. Current methodology chooses to implement a 4-person prisoner dilemma game:

Table 1:
Returns for Player per Token in 4-person Game

Player 4		Contribute				Don't Contribute			
Player 3		Contribute		Don't Contribute		Contribute		Don't Contribute	
Player 2		Contribute	Don't Contribute	Contribute	Don't Contribute	Contribute	Don't Contribute	Contribute	Don't Contribute
Player 1	Contribute	(230, 230, 230, 230)	(170,280, 170,170)	(170,170, 280, 170)	(110, 220, 220,110)	(170,170, 170,280)	(110,220, 110,220)	(110,110, 220,220)	(50,160, 160,160)
	Don't Contribute	(280, 170, 170, 170)	(220, 220, 110, 110)	(220, 110, 220, 110)	(160, 160, 160, 50)	(220, 110, 110, 220)	(160, 160, 50, 160)	(160, 50, 160, 160)	(100, 100, 100, 100)

In the game, there are 4 players endowed with 50 tokens each; which they have to distribute between public good and private good. If a player 'contributes' he invests his token in the public good, if he 'does not contribute' he invests the token in the private good. Each token is worth Rs.100. The private good yields a private benefit of 100% (Rs. 100) on each token invested in it. The public good yields a private return of 50% (Rs. 50) to the investor and a public return of 60% (Rs.60) to group members i.e., the remaining players[1]. The remaining players will reap this 60% benefit regardless of whether or not they have contributed towards the public good.

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[1] Net gain from investing in a public good exceeds that of a private good.

For example, considering Table 1, in the bolded scenario (Rs. 280, Rs. 170, Rs. 170, Rs. 170), player 1 does not contribute whereas players 2, 3 and 4 contribute towards the public good. The maximum benefit is hence yielded by the free-rider, player 1 i.e., 280. This occurs as a result of player 1 obtaining the full return of investing the token in the private good (Rs. 100) combined with the additional 60% benefit reaped by the public investments of his group members (60+60+60).

In the game, it is in the player's interest to free-ride because the private benefit of the private good is greater than the private benefit of the public good (Rs. 100 > Rs. 50). However, the socially optimal result is for everyone else to invest in the public good because the social benefit of the public good is greater than the private benefit of the private good (Rs. 230[2] > Rs. 100)2. For this result to occur, communication and cooperation must be present between group members.

Though there is a possibility that cooperation will occur by chance, economic theory predicts that each individual possesses a strong dominant strategy to defect i.e., not contribute (Bowles & Gintis, 2013). Rationally, the individual benefits of not contributing are greater, no matter what any other agent does. This strict preference impedes the ability of rational agents from achieving the social optimum.

3.2   Experiment

To obtain the relevant data, we conducted a standard Public Good Experiment (Maxwell & Ames, 1981). As a variant to the typical public good game, in this experiment, the variable of social pressure is added. Not only will the experiment capture the individuals' natural willingness to pay, but it will also find out how contribution decisions vary when social pressure is introduced. This way, the experiment differs from the standard Randomized Control Trials (RCT) as, instead of having separate control and treatment groups, in our experiment, the same individual is subjected to both control and treatment situations, with the variations in responses being analyzed for this research.
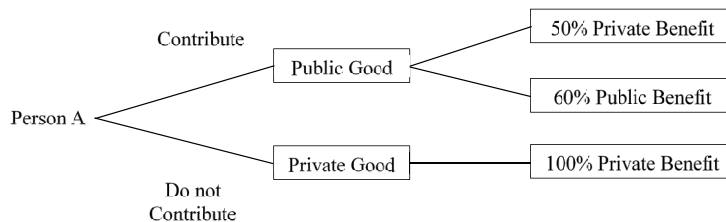
Figure 1: N-person Prisoner Dilemma Game

[2] In order to obtain the optimum benefit of 230: All players contribute towards the public good. Hence, each player's private benefit is Rs.50 per token combined with Rs.180 (60+60+60) that they get from the remaining players contributing towards the public good as well. Hence, each players returns = 50+60+60+60 i.e. 230

The public good game was repeated over six rounds; however, the total number of rounds were not communicated to the participants at the start of the experiment. In each round, subjects were provided with 50 tokens, and they had to allow them to either Good A or Good B. Good A characterized a public good, with the marginal per capita return (MPCR) to the contributor being 0.5 for every 1 token contributed and 0.6 to the rest of the society. Similarly, Good B represented a private good where only the contributor reaps the return of a hundred per cent on each token contributed (whether the good represented a public good or a private good was not communicated to the participant, the participants made their contributions based solely on MPCR). For the first three rounds, group size was not defined and there was no inclusion of social pressure; individuals were not allowed to communicate or reveal their contribution decisions. From round four, groups consisting of four participants each were formed, and social pressure was introduced in the form of mandatory revealing of contribution decisions to fellow members, and allowing communication. It is important to note that only intra-group communication was permitted, with no inter-group communication permitted. The participants were given instruction sheets that aided their understanding of the experiment and provided everyone with a uniform format to write down their contribution decisions. A copy of the instruction sheet is added in the Appendix.

The sample consists of 208 university students[3]. The students were selected from different departments (engineering, social sciences etc.) and different years (first, second, third etc.) to ensure maximum possible generalization of sample results.

3.3   *Research Variables*

In the current experiment, the dependent variables are the contributions made to Good A (a public good) in the three rounds of control and treatment, whereas the independent variables are social pressure and group size. The analysis reveals whether the interaction of these independent variables affects the dependent variables and whether free ridership emerges as the dominant strategy in the conducted public good game.

4.   **Results**

From the data collected, some basic information can be deduced to infer the behaviour of individuals when it comes to contributing to public goods.

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[3] All participants were students of National University of Sciences and Technology, Islamabad.

4.1   Willingness to Pay for Public Goods across rounds
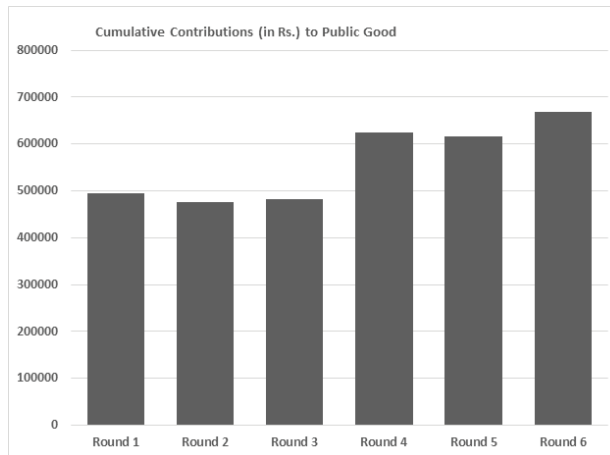
Figure 2: Cumulative Contributions (in Rupees) towards a Public Good.

From Figure 2, it is apparent that individuals do exhibit a tendency to contribute to public goods, even though in literature. This tendency to contribute to public goods is seen to amplify once social pressure is introduced in the experiment (Round 4 onwards) (Reyniers & Bhalla, 2013).
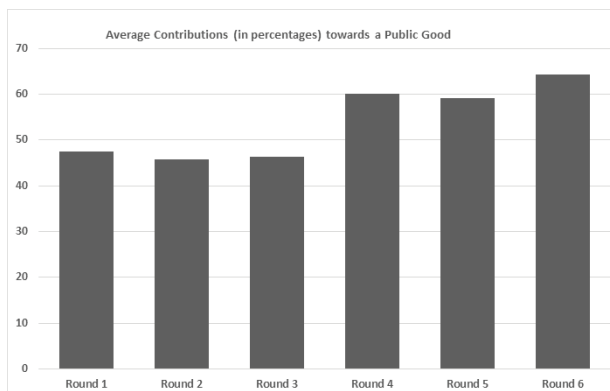
Figure 3: Average Contributions (in Percentage) towards a Public Good.

It can be seen, in Figure 3, that even in Round 1, with undefined group size and no social pressure, individuals on average contribute more than 40% of their tokens to public goods, showing that individuals have an altruistic tendency. Andreoni (1988) states that when public good games are repeated over a finite number of times, the contributions of individuals 'decay' as they realize that free riding is the dominant strategy. However, in this experiment, no such constant decay is witnessed. Even though the average amount contributed decreased

in the second round, the amount is seen to slightly increasing again in Round 3. This indicates that individuals do not adhere to a specific strategy, but rather contribute differently to each round. However, in many experiments from literature, (Isaac & Walker, 1988; Kim & Walker, 1984), this decay is normally apparent in the end rounds of the game. This variation of current findings from the ones done in the past can be attributed to the number of rounds played. Most experiments have more than 10 experimental rounds, in some cases as many as 25 games with 10 rounds each played back-to-back (Selten & Stoecker, 1986), so it could mean that the 'decay' is experienced over a longer time period (increased number of rounds) than the one in the current experiment. Furthermore, the presence of social pressure and smaller group size in the later rounds could also be deterring the decay in contributions.

Overall, it can be seen that once social pressure was introduced in Round 4 (onwards) and groups of four individuals were created, a clear increase was observed in the average contributions. This shows that individuals are susceptible to pressure and show a desire to portray 'good' behaviour (Reyniers & Bhalla, 2013). The maximum average contributions were noted in Round 6.

4.2   Effect of Social Pressure on Group Contributions
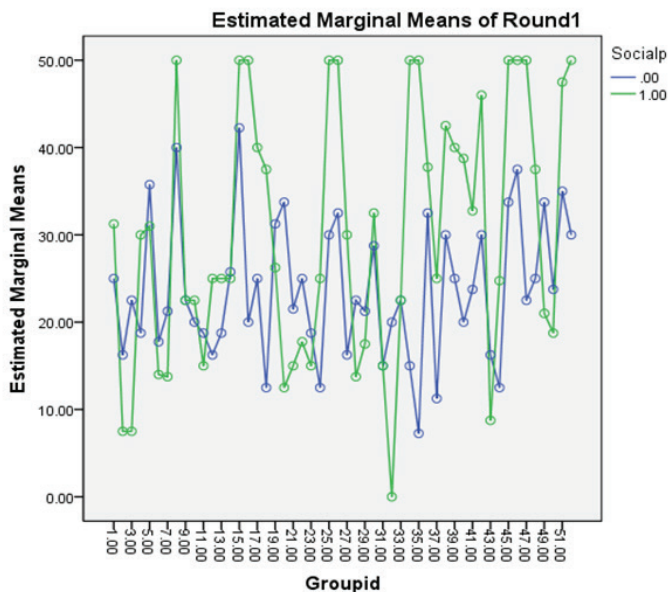
Figure 4: Estimated Marginal Means of Round 1(with and without social pressure)
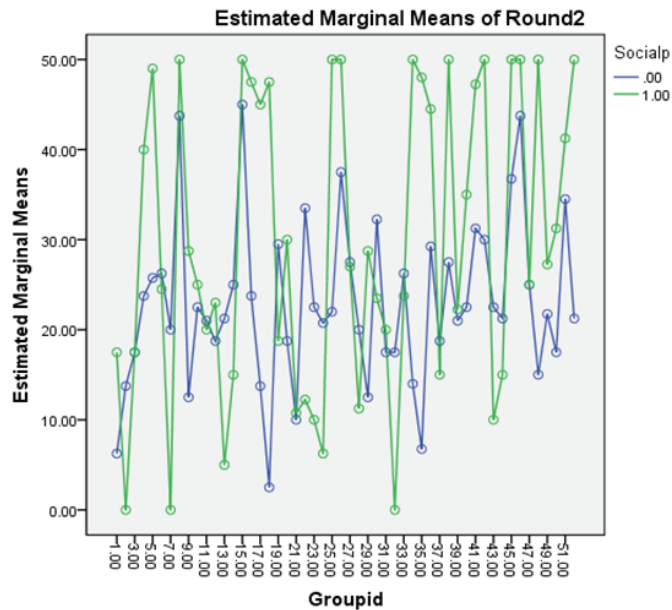
Figure 5: Estimated Marginal Means of Round 2 (with and without social pressure).
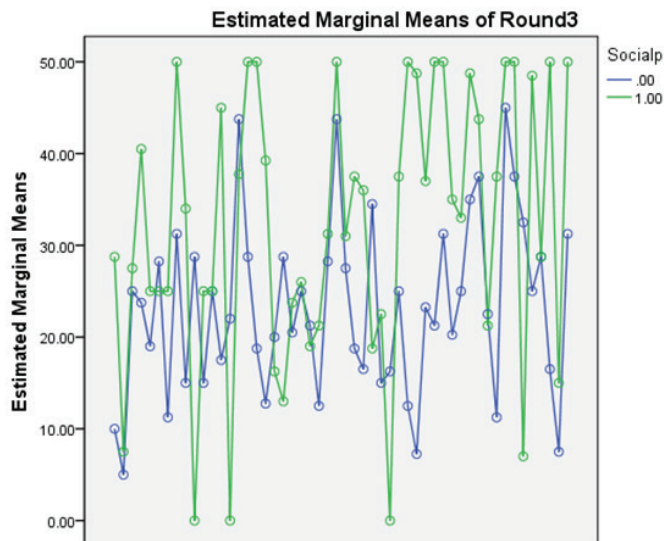
Figure 6: Estimated Marginal Means of Round 3 (with and without social pressure).

As evident in Figures 4, 5 and 6, the estimated marginal mean of each group changes once social pressure is introduced i.e., revealing contribution decision becomes mandatory and communication is allowed. The same effect pattern can be observed in all three figures. Group members with social pressure have more extreme values than those without social pressure. This indicates that once group members communicate and reveal their decisions, they develop a level of cooperation between them (as indicated by extreme mean values that show that variations between tokens contributed decreased). Whether groups cooperate to contribute less or more depends on the group dynamics and the members' perception of Good A (public good).

Overall, a high level of cooperation, whether voluntary or involuntary, is observed once social pressure is introduced in the public good game.

4.3   *Free Ridership*

It is evident from both average contributions and cumulative contributions that individuals do not dominantly free ride. Yet there are some individuals and groups that do display some free-riding tendencies. For the current analysis, two measures have been used to calculate free ridership. The first adheres to conventional economic theory; because an individual gains the greatest return, it is in his self-interest to completely free ride and contributes zero tokens to any public good (Ledyard et al., 1997). In the current study, these types of free riders are termed as the 'Absolute Free Riders'. The second kind of free ridership is analyzed with slightly relaxed assumptions. Any individual that contributes less than 20% of the total token endowment is referred to as the 'Free Rider with the 20% Rule. This assumption is taken from Maxwell and Ames (1981[4]).

Table 2:
Free Riders with the 20% Rule and Absolute Free Riders

Free Riders with the 20% Rule		Absolute Free Riders		Overall Free Ridership	
Without Social Pressure	18.27%[5]	Without Social Pressure	5.29%	With 20% Rule	4.81%
With Social Pressure	9.62%	With Social Pressure	3.37%	Absolute	0.96%

Once social pressure is introduced, free riding (with the 20% rule) decreases by almost half, meaning that when the actions of individuals become largely observable, individuals generally resist free-riding temptations. With absolute free riders, the same is observed. In Table 2, however, post social pressure decrease in free riders is not as prominent as that seen with

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[4] In the paper, six economists and a sociologist were gathered to predict the outcome of the experiments before they were conducted. The average predicted contribution by the gathered 'experts' was found to be 20% of the total tokens.
[5] This value is calculated using the following formula, (no. of free riders/208)*100.

free riders calculated using the 20% rule. When the six rounds are considered altogether, the percentage of free riders is extremely low. This shows that while individuals may free rider in some rounds, it is highly unlikely for them to free ride in all of the rounds consistently.

4.4   MANOVA Results

MANOVA is a statistical technique used to analyze the inter-group differences between more than one continuous random variable; groups are defined according to the same independent variables for each of the dependent variables. A schematic layout of the general setup for the MANOVA model is given in Equation (2).

$$
\begin{bmatrix} Y_1 \\ Y_2 \\ . \\ . \\ Y_n \end{bmatrix} = \begin{bmatrix} f\left(X_1, X_2, \ldots X_n, I\left(X_i, X_j\right)\right) \\ f\left(X_1, X_2, \ldots X_n, I\left(X_i, X_j\right)\right) \\ . \\ . \\ f\left(X_1, X_2, \ldots X_n, I\left(X_i, X_j\right)\right) \end{bmatrix}, \; i \neq j, \; I \text{ represents the interaction effect.}
\tag{2}
$$

Just like its univariate version i.e., Analysis of Variance (ANOVA), the Multivariate Analysis of Variation (MANOVA) partitions the total variation in the dependent variables into two components: variation due to the independent variables, or the treatment sum of squares, and variation due to unpredictable random factors, or the residual sum of squares. Pillai-statistic in MANOVA is the counterpart of the F-statistic in ANONA, this statistic is approximated by the F-distribution (Muller, 1998). A significant Pillai-statistic implies that the group differences are significant for the ith dependent variable, $i = 1, 2, \ldots n$.

Table 3:
Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.907	1003.538[a]	3.000	310.000	.000	.907
	Wilks' Lambda	.093	1003.538[a]	3.000	310.000	.000	.907
	Hotelling's Trace	9.712	1003.538[a]	3.000	310.000	.000	.907
	Roy's Largest Root	9.712	1003.538[a]	3.000	310.000	.000	.907
Group-ID	Pillai's Trace	.975	2.945	153.000	936.000	.000	.325
	Wilks' Lambda	.279	3.224	153.000	930.141	.000	.346
	Hotelling's Trace	1.746	3.523	153.000	926.000	.000	.368
	Roy's Largest Root	1.142	6.988[b]	51.000	312.000	.000	.533
Social Pressure	Pillai's Trace	.162	20.034[a]	3.000	310.000	.000	.162
	Wilks' Lambda	.838	20.034[a]	3.000	310.000	.000	.162
	Hotelling's Trace	.194	20.034[a]	3.000	310.000	.000	.162
	Roy's Largest Root	.194	20.034[a]	3.000	310.000	.000	.162
Group-ID * Social Pressure	Pillai's Trace	.861	2.463	153.000	936.000	.000	.287
	Wilks' Lambda	.358	2.484	153.000	930.141	.000	.290
	Hotelling's Trace	1.242	2.506	153.000	926.000	.000	.293
	Roy's Largest Root	.588	3.595[b]	51.000	312.000	.000	.370

a.   Exact statistic
b.   The statistic is an upper bound on F that yields a lower bound on the significance level
c.   Design: Intercept + Group-ID + Social Pressure+ Group-ID*Social Pressure

Table 3, shows the statistics of each of the four separate multivariate test statistics, which are: Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root. These tests examine the statistical significance of the different effects of the independent (fixed) variables in the model. Keeping in view the guidelines from the literature (Tabachnick et al.,2007; Finch et al.,2011), Pillai's trace statistic is used for determining the significance of the main effect and the interaction effects; it is a robust statistic that performs efficiently in different settings of the MANOVA model (Tabachnick et al .,2007). From the table above, it is evident that for both social pressure and group ID, the p-values are less than 0.05, meaning that the effect of both these variables is statistically significant. However, from the values of Pillai's trace, we assess that overall, the effect of groups is stronger than that of social pressure (as the value of group ID is closer to 0). Secondly, the interaction effect, "group ID* social pressure" explains whether the effect of social pressure is consistent across the various groups. Since Pillai's statistic is significant, it is concluded that the effect is consistent and statistically significant.

The partial "Eta Squared" column denotes the measurement of the size of the interaction effect of the two independent variables on the dependent variable. It portrays the practical significance of each term, based upon the ratio of the variation (sum of squares) accounted for by the term to the sum of the variation accounted for by the term and the variation left to error. Thus, we will focus on the "Group ID*social pressure" row in this case. Larger values of partial Eta square indicate a greater amount of variation accounted for by the model term, to a maximum of 1. The value of partial Eta square corresponding value of Pillai's test shows that nearly 29% of the variability in the contributions made towards Good A can be contributed to the interaction of group ID and social pressure. This means that, aside from the effects being analyzed in the model, other unknown effects also have a significant impact on an individual's willingness to pay for the public good.

Table 4 shows the analysis of the variance. It is reporting the results of the ANOVA tests on the dependent variable i.e., contributions made in Round 1, 2 and 3(with and without social pressure). Initially, we focus on the values of "group ID* social pressure" interaction as this will help us on determining the significance of the results. Keeping this in mind, we once again observe that the results are significant since all the p-values are less than 0.05. This proves the statistically significant differences present between group ID, social pressure, and their interaction.

Furthermore, the value of partial Eta square will guide us to understand the effect size of social pressure and group ID separately as well as collectively on the contributions made towards Good A. As shown in Table 4, the values for partial Eta square for "group ID*social pressure" have varied in all the rounds. In Round 1, the value was 0.26, while in Round 2, it increased to 0.358. This shows that the impact of social pressure and Group ID has increased the number of contributions made towards the public good. However, in Round 3 there was a slight drop from 0.358 to 0.304, but 0.304 is still greater than 0.26, thus showing that the presence of social pressure and group ID does affect one's contributions towards a public or a private good. On the other hand, if we look at the two independent variables separately, we observe that the values of partial Eta square for group ID are much greater than those for social pressure. This shows that group ID has a greater effect on the decision making of the contributors as compared to social pressure. Moreover, the partial Eta squared for social pressure shows an increasing trend from Round 1 to Round 3. This shows that as the rounds progressed, the effect of social pressure became more pronounced, thus making them switch from contributing to the private good to contributing to the public good.

Table 4:
Tests of Between Subject Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Round 1	59927.413[a]	103	581.820	3.426	.000	.531
	Round 2	77633.990[b]	103	753.728	4.856	.000	.616
	Round 3	71800.837[c]	103	697.096	3.899	.000	.563
Intercept	Round 1	300785.087	1	300785.087	1771.077	.000	.850
	Round 2	286755.010	1	286755.010	1847.549	.000	.856
	Round 3	318683.163	1	318683.163	1782.395	.000	.851
Group-ID	Round 1	37186.913	51	729.155	4.293	.000	.412
	Round 2	45965.490	51	901.284	5.807	.000	.487
	Round 3	38985.087	51	764.413	4.275	.000	.411
Social Pressure	Round 1	4087.538	1	4087.538	24.068	.000	.072
	Round 2	4657.846	1	4657.846	30.010	.000	.088
	Round 3	8424.000	1	8424.000	47.115	.000	.131
Group-ID*Social Pressure	Round 1	18652.962	51	365.744	2.154	.000	.260
	Round 2	27010.654	51	529.621	3.412	.000	.358
	Round 3	24391.750	51	478.270	2.675	.000	.304
Error	Round 1	52987.500	312	169.832			
	Round 2	48425.000	312	155.208			
	Round 3	55784.000	312	178.795			
Total	Round 1	413700.000	416				
	Round 2	412814.000	416				
	Round 3	446268.000	416				
Corrected Total	Round 1	112914.913	415				
	Round 2	126058.990	415				
	Round 3	127584.837	415				

a.   R Squared = .531 (Adjusted R Squared = .376)
b.   R Squared = .616 (Adjusted R Squared = .489)
c.   R Squared = .563 (Adjusted R Squared = .418)

Overall, the current experiment provides support for three main results. Firstly, that people have altruistic tendencies and do not display profit-maximizing characteristics. This is indicated by the fact that from the first round till the last, each individual on average donated at least 40% of their tokens to the public good. Secondly, social pressure and group settings have a positive and significant impact on the individual contributions made to the public good. This effect is depicted in Figures 2-5. When the treatment effect (inclusion of social pressure) is introduced in Round 4 onwards, both cumulative and meaningful contributions to public goods are generally observed to increase. Furthermore, the FRH is rejected in this experiment, with only less than 5% of participants exhibiting free-riding tendencies in the 6 rounds simultaneously (as evident in Table 2).

5.   Discussion

This study is an attempt to mimic a real-life scenario in which individuals have a choice to opt between personal benefits and communal benefits. To create cohorts that can reflect different real-world scenarios, the study dichotomized the game design into two settings: the first one was when an individual was made to play the game and contributions were anonymous, while the second set was the case when people played in a group, group size was fixed, and intragroup communication was allowed. This game design allows one to analyze two real-world scenarios: one is when individual philanthropic behaviours are studied, while the other one is when people do philanthropic practices as a result of campaigns that target social groups, such as friends, members of a club, or colleagues in a workplace. It was observed that the existence of social pressure decreased the likelihood of free ridership. The magnitude of contributions was significantly less in solo settings as compared to group settings; furthermore, as the game progressed contributions toward the public goods decreased.

The solo settings of the game are a good description of human behaviour when they rely on the "quick thinking" or the system-I of the brain that takes on-spot decisions. It depicts the human psyche that they think about personal gains more than the communal gains when they take quick decisions. However, even in such scenarios, they do not totally denounce the benefits of contributing to communal gains. The reflective system-II of the human brain comes into play in group settings because the later outcomes of the game are linked with the earlier ones. In simple words, when people observe that they have been noticed by their peers for a long time then their system-II signals them that it is a time to behave socially desirable.

5.1   Conclusion

The objective of this paper was to evaluate the behaviour of an individual in the context of the public good provision. Even though previous literature has termed 'Collective Action' as irrational, this study finds support for cooperative behaviour as well as a voluntary contribution to public goods. On average an individual willingly donated more than 40% of the endowment towards the public good, even without any additional motivating factors. This tendency was only observed to be amplified once social pressure was introduced and groups consisting of four members were created. Moreover, this experiment provided little to no support for the FRH in both its forms (Free rider with 20% rule and absolute free-rider).

5.2   Implications, Limitations and Avenues for Future Research

The importance of this study is highlighted in post-COVID times when governments worldwide are required to be frugal. Philanthropic practices have the potential to support the government if it succeeds in winning public trust. In the case of Pakistan, the unprecedented mix of public, corporate, and nonprofit activity in the development realm that is growing in Pakistan is profoundly altering the way we approach our most pressing social issues. According to the Pakistan Centre for Philanthropy, the annual amount of charitable giving in Pakistan is 70.538 billion rupees (Pakistan Centre for Philanthropy, 2017). With so much huge potential in the philanthropic channels, there is a need to develop a mechanism to streamline this money for the benefit of the country in such a manner that it strengthens the macroeconomic indicators. This is only possible if the government can win public trust and design charity campaigns effectively. In this context, the current study is an oriel into a newer perspective about using human capital to improve the economy. The findings of this study shall interest those who want to tap into unconventional solutions to boost the economy.

Repeated solo philanthropic campaigns should be designed in such a manner that there is some gap between subsequent calls for charities. This roots out from the results of the current study in a sense that as rounds proceeded (in solo settings), the contributions towards the public goods tapered off. Repeated group philanthropic campaigns may be designed with lesser gaps between subsequent calls for charities. This roots out from the results of the current study in a sense that as rounds proceeded (in group settings), the contributions towards the public goods increased. The study offers interesting insights for the stakeholders who design charity campaigns. It was noticed that contributions are higher in group settings as compared to solo settings; therefore, crowdfunding initiatives are a better option than individual charity solicitations.

Limitations of the current study include its reliance only on students as study participants. There is a need to analyze the role of group composition (such as average age of participants, diversity in terms of socioeconomic background, gender, and educational

qualification). The findings of the study, though relevant, require improvement in terms of generalizability because the study population was restricted in the sense that the participants were university students. To better analyze the complexities of human philanthropic behaviours, there is a need to conduct observational studies or real-time social experiments in which real money is used. Furthermore, even in real-time social experiments, it remains unknown what the difference in giving behaviour is when the money is earned versus when it is an endowment.

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Appendix
Instrument

Instructions

You have been given a total of 50 tokens, and you have to donate them to either Good A or Good B, or both Good A and Good B. You can decide how many tokens you want to donate to each good.

For every 1 token (which is worth Rs.100), donated to Good A, you get a return of 50% (Rs.50) and everyone else gets a return of 60% (Rs.60). Similarly, for every 1 token that everyone else donates to Good A, you get a return of 60%; regardless of whether or not you have given to the good.

For every 1 token (which is worth Rs.100), donated to Good B, you get a return of 100% (Rs.100). On this good, only you earn the return from donating, no one else will earn returns from your donation to Good B.

The rest of the instructions will be communicated to you.

Rounds	Good A	Good B

Thank you for participating in this exercise. Have a Good Day!

Validation of the Students' Cognitive Engagement Measure: Evidence from University Students of Karachi

Shafaque Fatima*, Kalpina Kumari**, Yawar Abbas Sandhu***, Jawad Abbas****

Abstract

The goal of the study is to determine the validation of the Cognitive Engagement measure of students in the context of Pakistan. The rationale for such an investigation is that while enrollments in Pakistani higher education are increasing, passing out numbers are very low; this problem necessitates an investigation of student cognitive engagement as well as other factors. Because the Construct of Engagement arose in response to the issue of lower student turnout. The Cognitive Engagement Subscales of Attitudes towards Mathematics (ATM) were used to collect data for this study, and the convenience sampling technique was used. The sample included 528 university students from ten different universities in Karachi. The Structural Equation Modeling (SEM) approach was used for data analysis. The results revealed 21 items that were compatible with the Pakistani context, with Shallow Strategy Use (SSU) being the most endorsed subscale with a mean of 3.7. This study provided a validated instrument for future studies to determine cognitive engagement levels. Future research should look into other disciplines and the relationship with other variables.

Keywords: Pakistani higher education; cognitive engagement; higher education; validating factor structure; data analysis.

JEL Classification: ZOO

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1.   Introduction

Student engagement is a concept that represents the degree to which a student active-ly engages in learning activities (Fredricks et al., 2011). The concept of student involvement has received a lot of attention in education research, policy, and practice in recent years. This might be because of its documented connections with desirable scholastic and non-scholastic outcomes such as academic success (Reyes et al., 2012), school completion (Archambault et al., 2013), and physical and psychological well-being (Steele & Fullagar, 2009). Natriello was one of the first researchers to establish a formal explanation of the concept of student involvement (Mosher & MacGowan, 1985). Engagement, according to Natriello (1987), "ex-ists when pupils participate in the activities given as part of the school curriculum.

However, the problem has mostly been explored via the lens of disengagement, which appears as absenteeism (i.e., unexplained absence), indifference (i.e., a low level of effort), and criminality (e.g., cheating, stealing). Several factors such as students' origin, learning environment, and school policy can influence involvement, which in turn affects students' academic achievement and social behaviors (e.g., disrupting classroom activities).

Although Natriello (1987) conceptualization of student involvement as a purely be-havioral variable comprised of school participation and behavior was limited, it did open the door for future conversations in the education field. Researchers have sorted out or derived models from motivational theories and models, therefore it is not a novel construct. The no-tion of Engagement, like motivational theories, has three dimensions: emotional, behavioral, and cognitive.

Researchers have sorted out or derived models from motivational theories and mod-els, therefore it is not a novel construct. The notion of Engagement, like motivational theories, has three dimensions: emotional, behavioral, and cognitive. Interest, assimilation, attentive-ness, and active participation in learning activities are all examples of cognitive engagement, as is the desire to learn new things more than academic requirements. Because engaging or disengaging students cognitively affects their behavior and academic engagement (Fredrick's & Paris, 2004). Cognitive engagement plays a dual role. In the last ten years, researchers have begun to focus on the concept of student engagement.

University enrolment in Pakistan started increasing since 2001-2002 in the subse-quent years; during 2010-2015 Pakistani higher education witnessed a 78 percent increase in the number of universities and degree-awarding institutions, consequently, student enroll-ment increased profoundly by 174 percent (HEC, 2015). The main reason was a change in government policies towards higher education. The private sector was provided incentives to enter (Economic Survey of Pakistan, 2015) and mushroom growth of private universities started. That increase in the number of universities led to an increase in enrollment to great

extent; nevertheless, the enrollment rate is still lower than in other South Asian countries (HEC, 2015). See Table 1 for detailed enrollment information of respondents.

Table 1:
Number of Enrollment and Passing Out

Year	Total Enrollment	Number of Passing Out
2005-06	511030	380995
2006-07	628257	362684
2007-08	726314	449153
2008-09	803507	496207
2012-13	1222543	211831
2013-14	1222543	248191
2014-15	1275907	228617

However, it evident from statistics available in different HEC publications is that student turnout has been decreasing (Sultana, 2017; Muslim et al., 2017; Zaheer et al., 2016). This could be due to higher dropout rates (Khanam et al., 2016) or low student achievement. Moreover, since proper planning and long-term perspective was not kept into consideration, this increase in human capital has not significantly contributed to economic development (Asghar & Zahra, 2012). Such a problem "exerts a harmful effect on the investment in education by creating a non-productive and non-innovative environment" (Khanam et al., 2016).

This issue of lower student turns out necessitates an investigation of the level of student cognitive engagement as well as other factors that contribute to the low passing rate. Few studies in Pakistan, have included cognitive engagement aspects in part, such as Ullah et al. (2014), who investigated three cognitive engagement variables: in-depth, surface learning, and monitoring in their study. In Items 21, 22, and 23, Iqbal et al. (2009) included cognitive engagement factors. Similarly, some researchers, for instance (Nomaan et al., 2016; Amir & Kamal, 2011; Nausheen, 2016; Munir & Rehman, 2016), have used the Motivated Strategies for Learning Questionnaire (MSLQ) in their studies, that investigated subscales of cognitive engagement, self-regulation, elaboration, and cognitive strategies, among other variables (Fredricks et al., 2012; Pintrich, 2004). It is worth noting that all Pakistani researchers did not use the term "cognitive engagement."

The primary purpose of this study was to confirm the appropriate factor structure of the Cognitive engagement scale in the context of Pakistan, in order to meet the validity and reliability (Schimmenti et al., 2020) by employing structural equation modeling.

1.1   Background of Study

Higher education in Pakistan is in a precarious state. It is not because people are inherently inferior in talent or moral values in comparison to any other nation in the world, but because of long colonial rule and imitation of other nations' systems, as well as political imbalance, that have spoiled some of the virtues and brought a bad name to the people's intellectual capacities. In Pakistan's history, university education got off to a shaky start. When Pakistan was founded in 1947, it had only one university: the University of Punjab in Lahore. Karachi University was established in 1950. Universities grew in the years that followed. The Lahore Institution of Management Sciences (LUMS) was the first private university in Pakistan, founded in 1984, followed by the Agha Khan University in 1985. The first significant growth in the number of public universities occurred under the Zulfiqar Ali Bhutto era, from 1971 to 1977 (Hoodbhoy, 2009).

1.2   Research Questions

Q.1 Is the Cognitive Engagement scale valid and reliable for Pakistani university students?
Q.2 What is the widely used cognitive engagement strategy among Pakistani university students?

2.   Literature Review

2.1   Conceptual Background

2.1.1   SAL and SRL Approach

Although the domain of motivation and learning for higher education research comprises several models and viewpoints "A key distinction in the field has been the contrast between two general perspectives".

- Student Approaches to Learning (SAL)
- Information Processing

Most European and Australian researchers opt for the SAL approach whereas the IP approach is more common among North American researchers. It is noteworthy that although various models have been derived from the IP approach in the recent era Self-Regulated approach (SRL) has replaced the IP approach. The rationale behind this replacement is that SRL is more comprehensive as opposed to the IP approach that only includes cognitive factors. Whereas the SRL approach includes motivation and environmental factors as well (Pintrich, 2004).

It appears that different research traditions have become closer in recent years. Researchers from many traditions are now accepting current themes that emphasize active, constructivist, situational, and collaborative components of learning (Lonka et al ., 2004). There is the emergence of another approach that is student engagement, it is not new rather separates the models from both SRL and SAL perspectives. Student engagement has the same three dimensions as motivational theories say, affective, behavioral and cognitive. A clear definition of (CE) is not clearly defined in available literature (Fredricks et al., 2016). Although, researchers following the SAL perspective describe CE in terms of deep and shallow cognitive strategies.

2.1.2   Cognitive Engagement

Because "cognitive and emotional engagement is potentially mediators of academic and behavioral engagement" (Reschly & Christenson, 2012), engaging or disengaging students intellectually and effectively precedes their behavior and academic involvement. Although there is little study on cognitive engagement, it focuses on broad concepts like thinking and the desire to put in the work required to achieve and learn complicated abilities and ideas. Following are the key components of student cognitive engagement

2.1.2.1 Self-regulation

Certain key assumptions of self-regulated learning were outlined by Zimmerman (2000). Although there are many different Self-regulation models, Pintrich claims that this assumption is the same in all of them. The first assumption is that learners actively engage in knowledge acquisition, making attempts to use both accessible resources and past knowledge. The next assumption is that a student has some influence over their learning processes and occasionally external circumstances as well, or that learners can self-regulate their learning process to some level (Pintrich, 2004).

The next premise is that a learner has a purpose to achieve and to do so, they manage their cognition, motivation, and behaviour" to govern their self-regulatory, motivational, and behavioral techniques and activities (Vermetten et al., 1999). The last premise is that a learner does not utilize her self-regulated methods just because of her personal history and priorities, nor alone because of the learning environment. To achieve her aim, a student uses self-regulated learning to relate her goals or objectives to classroom surroundings.

H1: The facture structure of the self-regulation sub-scale is sufficiently valid and reliable with the current sample.

2.1.2.2 Deep Strategy Use

Deep processing is a term used to describe a learner's efforts to foster the formation of progressively sophisticated structures of knowledge. For instance, if a student is using deeper thought while accomplishing any academic task, the students display elevated levels of (CE). This way of thinking has been related to higher academic accomplishment and a better understanding of course material (Entwhisle & Ramsden, 2015; Nolen, 1988; Miller et al., 1996; Garcia & Pintrich,1991; Schunk,1985). Deep processing techniques include re-phrasing or summarizing material, usage of drawings or diagrams to help in problem-solving, evaluation of understanding, comparison, and contrast (Miller et al., 1996, Hofer et al., 1998).

H2: Facture structure of deep strategy use is sufficiently valid and reliable with the current sample.

2.1.2.3 Shallow Strategy Use

On the other hand, Shallow engagement, explains a learner's surface-level cognitive participation focused on replicating rather than elaborating on learning content. These tactics are intended at internalizing knowledge as is, rather than adopting metacognitive processes to deepen an individual's grasp of course content. Repetitive repetition and rote memorizing of material, underlining or highlighting text while reading, and reviewing notes are all examples of shallow processing procedures (Zimmerman & Pons, 1986; Miller et al., 1996; Weinstein & Mayer, 1986; Hofer et al., 1998; Meece et al., 1988; Nolen, 1988; Ravindran, et al., 2005).

H3: The facture structure of shallow strategy use is sufficiently valid and reliable with the current sample.

2.1.2.4 Persistence

Persistence refers determination and hard work of a student towards academic activities in the face of difficulties. High levels of persistence significantly contribute towards the accomplishment of the tasks and/or course completion (Sakurai et al., 2012). Some researchers categorize persistence under behavioral engagement, whereas others as cognitive engagement (Fredricks et al., 2011), such as Miller et al. (1996) referred to persistence as a construct of cognitive engagement. Whereas Skinner and Pitzer (2012) categorized persistence as behavioral engagement.

H4: Facture structure persistence use is sufficiently valid and reliable with the current sample.

2.1.3   *Measurement of Cognitive Engagement*

Measurement of CE varies in accordance with operational definitions of the construct Cognitive engagement has been defined as (1) perceptions of the importance or value of schooling, learning goals, and prospects; (2) cognitive strategy use (how thoroughly students study material); (3) self-regulatory or metacognitive strategies (how students manage knowledge acquisition such as organizing and seeking information); and (4) doing extra work and going above and beyond schoolwork. Such cognitive engagement measures consider motivation, self-regulated learning, and strategy use. When we go for notions of deep and shallow for CE, we find its roots in the work of Marton (1986) and his fellow researchers in 1970. Lonka et al. (2004) in 1976 Marton and Saljo (1976) coined the terms of deep and shallow learning strategies. To explore the constructs of deep and shallow learning they used qualitative methodology. Marton (1986) developed a qualitative method named phonomyography that uses the lens of students' perspective developing through the interaction of students experience and the learning environment (Lonka et al., 2004). In terms of the value of self-report surveys, self-report data has considerably added to our understanding of motivation and cognitive engagement.

The first handbook on student engagement was published in 2012 wherein Fredricks and McColskey (2012) discussed in detail the surveys instruments that include subscales measuring cognitive engagement along with theoretical origins. In 2015, Green reviewed self-report surveys being used over 20 years, she also reviewed the studies that do not mention the CE but the work they have done falls under the umbrella term CE. Although Greene et al.(2004) follows the SAL school of thought in her review, she brought under discussion the self-report surveys from both SAL and SRL approaches. Such as details about the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich (1991) belong to the SRL approach.
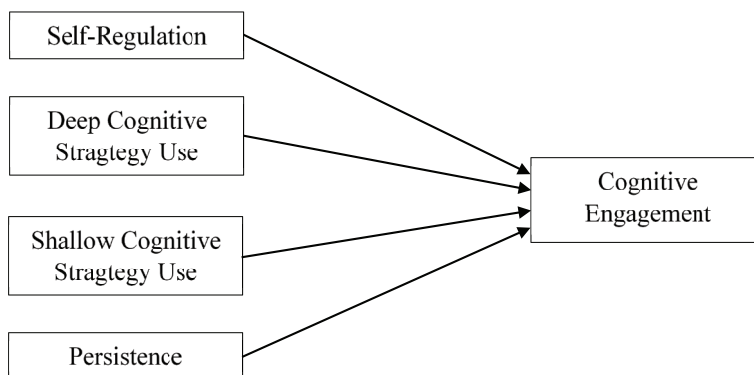

Figure 1: Research Model

3.   Methodology

3.1   *Research Design*

A descriptive method has been chosen for the current study. Descriptive research is defined as a research method that describes the characteristics of the population or phenomenon studied. This methodology focuses more on the "what" of the research subject than the "why" of the research subject (Siedlecki, 2020). However, the study's research topics include the description of university students' fundamental ideas and cognitive activities. Descriptive research is undertaken in many educational settings to "describe, compare, contrast, classify, analyze, and interpret the entities and occurrences" (Cohen et al., 2011) concerning people, practices, or content. A common descriptive method is survey design.

3.2   *Measure*

This study used Cognitive Engagement subscales of Attitudes towards Mathematics (ATM) an extensively validated measure in different cultures and subject domains (Fredricks & McColskey, 2012). As far as the utility of self-report surveys is concerned "self-report data have made significant and important contributions to the understanding of motivation and cognitive engagement" (Greene et al., 2004). This measure consisted of four subscales: self-regulation (9 items), deep strategy use (7 items), shallow strategy use (4 items), and persistence (8 items). Comprises 5-point Likert scale ranging from strongly disagree to strongly agree.

The Cognitive Engagement subscales of the Attitudes towards Mathematics (ATM) were used in this study, which is a widely validated measure across cultures and subject domains (Fredricks & McColskey, 2012). In terms of utility, "self-report data have made significant and important contributions to the understanding of motivation and cognitive engagement".

This scale had four subscales: self-regulation (9 items), deep strategy use (7 items), shallow strategy use (4 items), and persistence (8 items). A 5-point Likert scale ranging from strongly disagree to strongly agree is used.

3.3   *Sample*

The population of this study comprises all university students of Pakistan. For the current study, the convenience sampling technique has been employed, although it is a non-probability sampling technique still extensively used in social sciences research. The results of the convenience sample analysis can only be applied to the research participant group. It is critical to note that connections and effects discovered in a convenience sample

cannot be applied to a target population. Convenience sampling, on the other hand, is less expensive, faster, and easier than other types of samples. Convenience sampling can be used to create hypotheses and objectives for use in more rigorous research projects when no other sample method is practical (Stratton, 2021).

Moreover, a list of all enrolled students is very difficult to obtain for a trio of researchers with limited time and resources, therefore random sampling was not a feasible option. Data were collected from 6 public and 4 private universities in Karachi city, 600 forms from 650 were returned, 528 were complete and free from common errors. The response rate remained 81%.

In order to confirm the validity of the cognitive engagement scale; exploratory factor analysis was conducted with SPSS software. AMOS is a statistical software programme created by IBM. The Amos programme is specially developed to aid in the testing of hypotheses about the relationship between variables. We may use this programme to determine the strength of the association between variables, including latent and manifest variables. How substantial is the link between variables, and how well does the hypothetical model suit the real-world data? The benefit of Amos is that we don't need a sophisticated syntax or computer language to use it (Purwanto et al., 2021).

Table 2:
Demographic Variable

Total number of students	528
Number of universities	10
Public	6
Private	4
Gender	
Male	283
Female	234

4.   Results and Data analysis

Before initiating factor analysis in order to see whether missing data can be imputed or not for the reason being that AMOS requires complete data set for analysis, Missing Completely at Random (MCAR) test was performed, which yielded insignificant for all four variables i.e., self-regulation, deep strategy use, shallow strategy use, and persistence. Insignificant MCAR test refers that missing data pattern is random and can be imputed (Little, 1988). Then expectation-maximization procedure was employed to impute missing data.

Research question two is about the mean level of endorsement of the constructs. It is shown from table 3 that shallow strategy use (SSU) has the highest mean value (3.74) as compared to other constructs of higher-order thinking; self-regulation (3.67), deep strategy use (3.57), and persistence has the lowest value (3.11). It implies that students included in the sample are employing shallow cognitive strategies and have lower rates of persistence.

Table 3:
Descriptive Statistics

	N	Range	Min	Max	Sum	Mean	Std. Dev
srg_sum	528	4.00	1.00	5.00	1940.00	3.6742	.64530
dsu_sum	528	3.43	1.57	5.00	1888.00	3.5758	.63880
ssu_sum	528	4.00	1.00	5.00	1975.75	3.7420	.73349
prs_sum	528	3.13	1.88	5.00	1646.21	3.1178	.58979

Initially, exploratory factor analysis was conducted Orthogonal Varimax rotation was used as was in Miller et al. (1996) to scrutinize the dimensionality of factors. The value of Kaiser-Meyer-Olkin (KMO) 0.86 was sufficient to conduct analysis (Leech et al., 2005; Barkus et al., 2006). The Bartlet test of Sphericity was found significant at 0.05, sufficient to reject the null hypothesis. Items having lower loadings ($k < 0.30$) were deleted (Bandalos & Finney, 2018). A total of 21 out of 28-factor loadings were identified to be sufficient to moderate.

"Internal consistency is the amount to which individuals who answer in one manner to things tend to respond in the same way to other items meant to test the same construct," says the author (Fredricks & McColskey, 2012). If Cronbach's alpha is 0.07 or greater, reliability analysis is acceptable (Leary, 2004). In this study, the values were self-regulation (0.80), DSU (0.73), SSU (0.77), and persistence (0.77). (0.72). The CR values in the table are all more than 0.7, indicating composite measure dependability (Raykov, 1997).

Table 4:
Rotated Component Matrix

	1	2	3	4
srg1	.615			
srg2	.774			
srg3	.574			
srg4	.741			
srg5	.735			
srg6	.535			
dsu1	.517			
dsu2		.612		
dsu3		.833		
dsu4		.774		
dsu5		.564		
ssu1			.657	
ssu2			.736	
ssu3			.788	
ssu4			.734	
prs2_recode				.597
prs3_recode				.699
prs4_recode				.688
prs5_recode				.607
prs6_recode				.636
prs8_recode				.621

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.

Table 5:
Inter-factor Correlations

Inter-factor Correlations	II	III	IV	Composite Reliability	Cronbach Alpha
I. Self-Regulation	0.64	0.44	0.01	0.79	0.80
II. Deep strategy use		0.37	0.10	0.75	0.73
III. Shallow strategy use			-0.30	0.80	0.77
IV. Persistence				0.72	0.72

4.1   Construct Validity

Confirmatory Factor Analysis was used in the second phase to validate the factor structure since it "is a good method for evaluating construct validity" (Kline, 2005). Different measures were employed to assess model fit, the Comparative Fit Index (CFI), Root Mean Squared Error of Approximation (RAMSEA), Goodness of Fit Index (GFI), and Adjusted Goodness of Fit (AGFI) (Fan & Sivo, 2005), RMSEA (.058) and RMR (0.062) supported model fit (Hu & Bentler,1999), while GFI (.912) and AGFI (.887 >0.8) also indicate good model fit (Kline, 2005; Anderson, 1995), and TLI (.878) and CFI (.89) around 0.90 show satisfactory fit (Kline, 2005; Anderson et al., 1995). Table 4 shows the results. Validated convergent and discriminant validity (Kline, 2005) results appear in table 3. Inter-factor correlations (Table 3) and figure 1 were determined to be weak to moderate. The results show that SSU is the most approved subscale, with a mean of 3.7.

Table 6:
Model Fit Indices

CFI	RAMSEA	GFI	AGFI	TLI
0.89	0.58	0.912	0.887	0.878

5.   Discussions and Conclusion

In this study negative relationship was found between persistence and shallow strategy use. This relationship is consistent with literature although not direct instead it is needed to understand the relationships of another construct. There are certain predictors/and or associated variables of shallow or surface-level strategies such as performance goals i.e., learning for the sake of good grades to get appreciation from family, and peers/teachers instead of the zest of learning (Miller et al., 1996). In this regard, it is argued students who are inclined towards performance goals, when confront with difficulties they show low persistence and their performance falls, and they are more at risk of dropping out. On the other hand, students interested in learning goals tend towards deep strategy use, self-regulation and even in the face of difficulties show higher levels of persistence, for the reason being that they feel pleasure in learning new things and remain open for challenges as well (Miller et al., 1993).

As far as mean levels of endorsement are concerned shallow cognitive engagement was found most endorsed. This result is very much consistent with what researchers have been indicating in various studies (Iqbal et al., 2010) another study employing a larger sample of 1850 university students found a lack of self-regulation, loss of confidence, and anxiety problems, although judgment cannot be made mere on student's self-reports, without thorough examination this result at least show students' perspective (Saleem & Mahmood, 2013). When students are facing such problems their risk of dropout increases, and mental discomfort decreases their learning and achievement (Greene et al., 2004; Fredricks et al., 2011).

To some extent existence of shallow engagement is of point of concern because students need to memorize a few things, as well as follow certain patterns as for research writing students must follow certain styles. The problem may occur when shallow engagement becomes problematic when it is a predominant construct as compared to other cognitive engagement constructs fall under the deep engagement phenomenon. It is evident from various research studies that deeper level processing i.e., self-regulation, deep strategy use, and persistence is associated with a higher level of performance. Whereas shallow engagement is associated with lack of interest, low achievement, and higher dropout rates (Garcia & Pintrich, 1991; Greene et al., 2004; Greene & Miller, 1996).

5.1   *Academic Implications*

Cognitive involvement is an essential notion that has received little investigation in Pakistan and is still developing in the international arena. This research will contribute to both Pakistani and international research. Despite the study's shortcomings, it will equip other Pakistani researchers with well-validated tools. In the future, it is suggested that this instrument be improved with a larger sample size to ensure validity, as well as alternative approaches such as observation and teacher-administered surveys.

In this study shallow engagement was found most endorsed construct, to enhance students' deep cognitive engagement it is needed to collaborate students' expectations from learning activities with classroom instructions. Such as introducing topics/lessons in a way that is in line with students' future, to increase student achievement (Greene et al., 2004).

5.2   *Research Limitations and Future Recommendations*

Because this is a survey study, it is impossible to determine individual or small group concerns in educational settings. In the future, researchers may conduct qualitative investigations to provide a more in-depth study of the underlying condition.

It is impossible to guarantee that replies will be supplied honestly or unbiasedly, as with any self-report survey. Furthermore, because this study used convenience sampling, the results cannot be extrapolated to the target group of university students. Random sampling and longitudinal data studies can contribute a more robust piece of knowledge to the cognitive engagement construct.

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Why Industry 4.0 Adoption is Unavoidable for Sustainable Performance of Organizations?

Asghar Sohail*, Mirza Amin ul Haq**

Abstract

The purpose of this research is to endorse the importance of the fourth industrial revolution and its adoption in terms of organizational performance. In this study, we have discussed that the adoption of Industry 4.0 (I4A) parameters can improve production outcomes and reduce operational wastes. In order to comprehend whether Industry 4.0 parameters are feasible to accomplish, organizations should get valuable guidelines by differentiating the production outcomes vide pre and post-technological implementation. It has been revealed that organizations with industry 4.0 lean and sustainable practices have achieved more substantial upshots in social, economic, operational, and environmental performance i.e. overall Organizational Performance (OP). Likewise, prevailing global trends have indicated that innovative performance and adoption of Industry 4.0 technologies have become 'unavoidable' in the business arena, thus providing the sign to companies to start embracing developments related to process optimization in order to sustain or even reinforce the competitiveness. Conclusively, organizations should not only emphasize process automation but also introduce smart and credible systems for better outcomes.

Keywords: Industry 4.0 adoption; innovation performance; sustainability; green practices; organizational performance.

JEL Classification: L50

Organizations should also focus to incorporate Sustainability (SUS) and Green Practices (GP) through technological Innovation Performance (IP) so that operational, economic, and environmental performance could be enhanced. The empirical results of this study have proposed the academic, social, and managerial implications while adopting the viable parameters of the fourth industrial revolution. The data was collected from 297 respondents of Supply Chain Companies and Smart-PLS was used for analysis.

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1.   Introduction

In today's industrial environment, where concepts of smart factories are consolidating their application in companies, it is still necessary to approach management decision-making from a perspective that encompasses all aspects of sustainability without losing sight of the social return to which they must contribute. Basically, Industry 4.0 is a German originated peculiar concept of business automation, whose importance is the implication of innovation for proficient outcomes in production. Presently, the idea of smart production in smart factories is getting reasonable attention for its application in organizations, it is still important to get forward the decision making according to a viewpoint that incorporates sustainability aspects without deviating the social re-visit of which they should contribute (Naderi et al., 2019).

Industry 4.0 made smart industrial facilities and drove another production worldview dependent on the adoption of new innovations with respect to digital frameworks, augmented and virtual reality, cloud computing, the Internet of Things and the Internet of Services, etc. (Robert et al., 2020). In the light of different investigations the contextual results show that lean practices uphold efficacious adoption of I4.0 advances; acquainting such technological innovations are connected with fostering another sort of job profile; and more significant levels of industry 4.0 adoption which make an increased requirement for supportive or non-technical aptitudes (Cimini et al., 2021).

In business development organizations, refined parameters are adopted for the provision of supplies to the desired market places in appropriate quantity and serviceable condition by adopting lean parameters. There is a need to display models of how innovation capacity, competitiveness, and business growth can be built not solely from digitalization, supply chains literature, strategic management, and exploratory research, but integrating into business for scope embedded innovation and strategy within the industry 4.0 while thinking and acting in a smart way and becoming a part of smart society (Gerlitz, 2017).

One of the most significant challenges of Industrial Revolution 4.0 is the awareness and understanding of businesses about the change. Organizations must adapt and actively change their business operations, improve skills, and constantly apply technology. Numerous manufacturing ventures are perceiving the new innovations dependent on the establishment of the Industrial Revolution 4.0, which is altogether disturbing the current value chain of enterprises and makes a totally different method for maintaining a business (Nguyen & Luu, 2020). In terms of cognitive economy, it is important to assure quality perspective in Industry 4.0, which will animate the positive impact of the variables of manufacturing and industrial designing on the economy (Matytsin & Rusakova, 2021).

The implementation of Industry 4.0 is transforming the past trends of mechanical and electrical products because of smart services and products, into the items that contain sensors, programming's, hardware, information stockpiling, chip, and availability to release another rush of a contest wherein the customary traditional companies will make some intensive moments to get along. From a competitive perspective, product differentiation will be created through smart and savvy products, dynamic price value setting, customer relationship as well as segmentation (Sony, 2020).

The study is important with respect to the organizations and their subsequent supply chain strategies they adopt. The competencies prevailing among market players seek organizational capacities for further exploration of business opportunities. For such motives, the innovative capabilities of managers lead the organization towards progression and development. Likewise, business productivity is increased by implementing technological innovations. Sustainable green practices can be considered as a new, yet disregarded capacity of management operations. These can be ignored on the basis that typically lesser is known with respect to frameworks, in spite of global norms and environmental perspectives to environment, wellbeing and health and safety which have been observed (Yacob et al., 2019). Industry 4.0 and sustainability are significant points of discussion in manufacturing organizations. In any case, the association between these two ideas is less investigated in the literature. In prevailing business scenarios, the next generation of production companies is enormously affected by the dynamic nature of information technologies. Conclusively, the objective of this research criticizes I4.0 drivers to inculcate sustainable concepts in supply chains (Luthra et al., 2020).

Supply chain design and stable production consortiums should be set up to decrease the recurrence of supply chain interludes and to expand the adaptability to work with inappropriate underlying risks (Zhou et al., 2020). Sustainable practices can become good means to represent business obligations to companies from being receptive in handling the environmental pollution and squander and other feasible endeavors, to proactively adopt the accountability of business from raw components to the ultimate product disposal (Zailani et al., 2012). Jabar et al. (2011) have given the comments in their research paper that organizational performance is an important need for the development of the new product in Malaysian manufacturing industries. The authors have discussed the relationship between the strategic alliance partners. They do the agreements in order to grow better in the market and plan for further exploration to get the benefit.

In China, public authorities have given guidelines in sustainable perspective, suggesting that green development is basic to decrease the burden on climate or to diminish the cost and increase productivity. Generally, for small and medium-sized firms, significant expenses of sustainable products make it hard to accomplish green objectives, causing many firms to help out their supply chain network partners on green initiatives (Li et al., 2020).

Globalization has increased the number of customers who are environmentally cognizant and desiring for sustainable and green initiatives (Yacob et al., 2019). Government should develop environmental policies for green innovation and provide reasonable guidance to enterprises, as such policies have a decisive influence on the implementation of green innovation performance (Yang & Lin, 2020). We can strongly support the proposition that environmentally innovative practices bring economic, environmental, and operational benefits when compared to other companies (Zhu et al., 2012).

In industry 4.0, data management and cyber security have been handled by blockchain technology where trust has been acquired technologically. Information sent vide automated protocols should be checked and enabled with zero tolerance for transparency endurance, limiting the threat of information debasement (Howson, 2020). Proactively looking through the supply chain network for resourceful network accomplices permits supervisors to stay up to date with the most recent innovations and processes (Aslam et al., 2020).

Green process innovations endeavor fuzzily and affect the production cost. There are various schools of thought portrayed in literature, as indicated by which process innovation can emphatically affect adverse consequences on the marginal cost of production (Liu & Giovanni, 2019). Business progression is distinguished as a quest for inventive and new solutions reporting specific needs. Organizations that are more curious and working on their development, should continually foster comprehensive strategies for new products (Ungerman et al., 2018). Thoughtfulness regarding environmental sustainability addresses fundamental issues for the organizations to culminate the environment into strategical preferences by delivering explicit developments that have ensured environmental upshots. Implementation of green practices addresses an extraordinary challenge for non-green organizations since it consistently requires the procurement of new resource competencies that vary altogether from their prevailing capabilities (Calza et al., 2017).

In supply chains organizations, every member is to perform efficiently to create value as per job requirements. The accomplishment of sustainable green practices discloses the company's absorptive behavior capacity of outer information and its connections to skillful internalities. (Arfi et al., 2018). Green Innovations are increasingly more explicit as a way of supporting upper notch's, meeting the prerequisites, working on a corporate response, or separating from contenders (Albort-Morant et al., 2018). Therefore, green practices ultimately affect firms' financial and on green execution (Ahmed et al., 2018).

Nexus to the abovementioned lines, the research objectives of this study are narrated as needed to identify the attributes to increase the economic, operational, and environmental performance whether the organization is desired for / facilitated with I4.0 components. Secondly, an evaluation of the sustainable role of Green Practices in organizational economic, operational and environmental performance is required to explore.

Followed by the objectives, the following research questions have been identified for exploration; (1) What are the driving forces (motives) which stimulate the organizations to adopt/implement industry 4.0 technologies for economic, operational and environmental sustenance? and; (2) What are the attributes of sustainable green practices for increased outcomes in lean manufacturing processes?

2.   Literature Review

The institutional theory of information technology supports the foundation of this study. As theory is related to stability and persistence, information technologies are connected with fast, and now and then troublesome cultural and organizational changes (Currie, 2011). Staggered learning approaches recommend that people, groups, and associations act both autonomously and interface dynamically to add to organizational performance (Gottman et al., 1998). It is recommended that public policies leaning towards the adoption of sustainable green practices will significantly affect the fortifying countries' economies. Moreover, the progression of an adaptable energy asset framework will make mindfulness among manufacturing companies and assist them with working on their substantial presentation (Yadav et al., 2020).

To investigate the micro and macro viewpoints of green innovation to adopt industry 4.0 parameters and eco-friendly production, the research would improve insightfulness to comprehend the primary determinants of the Technology Acceptance Model (TAM) a firms' and industry 4.0 point of view. The review proposed micro and macro initiatives as energy–augmented TAM models and found that microenterprise TAM is related to green investment that builds the utilization of environmental-friendly interests to further develop coordination and execution, technological advancement, innovation, resourcefulness, and competencies. These variables would to a great extent backing to green practices, which are filled by green R&D consumptions (Anser et al., 2020).

The Theory of Planned Behavior states that behavior can be anticipated or disclosed by the objective to do so. It means that the purpose to support the utilization of innovation is an impetus to make a move, settle on choices about the utilization and adoption of innovations later on. Accordingly, the basic aim to use the information system is the objective of the end-user to utilize the new innovations. A review on the use of TAM to the utilization of information technology has likewise applied TAM theory to utilize which shows a significant relationship between actual decision and the intention to use (Ajzen, 2011). A number of reviews intend to assist SMEs with being more mindful of the advantages, difficulties, and advancements with the rapidity of Industry 4.0, subsequently working on the viability of the adoption of Industry 4.0, accordingly helping business exercises accomplish better outcomes to add to the economy in the solid momentum growth (Nguyen & Luu, 2020).

It is important for firms to rehearse great IT expertise for keeping an undeniable degree of IT security standards. Also, Industry 4.0 calls for new skills and leadership concerns and the board responsibilities. The managerial willingness and endorsement for large interest in more up-to-date innovations are important to develop feasible infrastructure for Industry 4.0. Firms should not just focus on smart manufacturing but also on quality frameworks and customers for better outcomes in human resources development and change management to bring social sustainability (Bag et al., 2018).

The general advantages of environmental collaboration in green processes involve the presence of a profit-Pareto-efficiency region. In any case, the environmental perspective neglects to happen in the Pareto-efficiency, which shows the jumble among economic and environmental execution. In addition, a lump sum value agreement may assist with upgrading environmental performance while supply chains may lean toward a profit-sharing agreement or vertical coordinated chain to augment benefits (Liu & Giovanni, 2019).

There is a direct and indirect impact of the managerial interactions in organizational performance in order to carry out the strategic outcomes. The research outcomes show that there is a positive relationship of direct relationship and a relatively indirect relationship of the direct relationship with the other members of the organizations in order to carry out the different strategic objectives (Srimai et al., 2011). Aforesaid in view, there could be an increase in the set of sustainability (SUS) indicators by including the effect of the green supply chain on organization performance (OP), just as further investigating the association between quality, lean and green practices for economic and sustainable performance (Micheli et al., 2020).

Industry 4.0 is identified with value addition to the manufacturing process (Frank et al., 2019). Notwithstanding the continuous exploration on energy effectiveness and development with regards to Industry 4.0, little is known on what level of spillages in the economy can mean for the energy-innovation. This issue has been highlighted to the United Nations in their Sustainable Development Goals (SDG) report. In Industry 4.0 era, this issue can be important from per sustainable development point of view (Chen et al., 2021). According to business respondents, the execution of market innovations promoting Industry 4.0 is itself a competitive advantage contrasted with different organizations. This is an increment in underlying performance coming about because of innovation (Ungerman et al., 2018).

The production side of supply chain resilience is directly associated with organizational performance, supporting the proposed supply chain empirically and for appropriate strategy (Gölgeci & Kuivalainen, 2020). Accordingly, manufacturers benefit the suppliers who have satisfied the purchasers as per a high level of commitment for smooth business relations. It is clear to mention that growth among supply chain partners is directly proportional to mutual development, commitment, and interest. For example, the agri-food industry, where

transshipment of the fresh food and vegetables is made from rural to urban areas, especially for the business malls, foster their systems, green processes, innovations, and plans of action to oblige the attributes of metropolitan and peri-urban agricultural products, for example, low and dynamic supplies and FMCG consumers those are supporting the farmers through reasonable exchanges (Nakandala et al., 2020).

In the same way, suggestions of another food project discovered the alternatives. It has relied that the conglomerates would foster another proposition on food safety and yet one that additionally broadens its extension to incorporate food handling and food quality, nourishment, food loss and wastage, sustainability, and so forth that reinforces the vocational arena made accessible to proficient partners because of their closely associated requirements and assumptions.

At the point when innovation performance becomes essential for the corporate strategy of the companies, top management will be serious about innovation performance, which will eventually make the organization on track to newness through the trickle-down effect (Aslam et al., 2020). The effect of innovative performance on sustainability highlights the commitments of top management and other stakeholders in the supply chain networks to the organizational dominance in the market (Tuan, 2016).

It is challenging to measure organizational performance, especially when the measurable components keep on changing. However, the concept of sustainability has radically explored the scope of measurement, and market leaders are particularly in problem what must be figured out continues to change. The idea of sustainability has significantly extended the extent of measurement choices and driving forces are grappling with sustainable mapping, however, there is no indication of consensus. It has been revealed these reporting standards are indescribably confounding (Hubbard, 2009).

How the Chinese manufacturing industry was improved by adopting lean operations in the industry. It has been observed that lean operation has a positive influence on industrial performance in operations. In this research human resources, supply chain, and production system design were studied in three dimensions of flexibility, flow, and quality. It was concluded that the design of the product has a significant impact on the performance of the engineers and technicians. The more the design is flexible, the more quickly will be the restoration of the desire of the customer. Designing and quality enhanced the performance of the employees working on technical sites.

There is a need to carry out the functionality test and evaluation of the structures to obtain the best practices in the system. The discussion how the companies performing the production and operations, are lean or agile. Basically, a lean manufacturing system coordinates the customer-oriented production system in which the user's desire can be nourished up

to a limit. Alternatively, the companies following the agile techniques are not flexible for the said opportunity. It indicates that the development of relationships with customers enhances product sales turnover and customer loyalty. For this purpose, the nurturing of managers is important who are directly dealing with the customers in the market (Netland & Alfnes, 2011).

Innovation performance is a never-ending process and the companies have to strive to accomplish it for achieving the feasible cost and profit, as well as increased customer goodwill and satisfaction, in order to enhance the forthcoming business. Therefore, the most appropriate mode of estimating and redesigning is the manufacturing measures performance that should be monitored and the execution plans evaluated on regular basis (Parthiban & Goh, 2011).

In business today, the development of Industry 4.0 for optimized production, and its associated advancements, like the Internet of Things (IoT) and cyber-physical frameworks, among others, have, nevertheless, an adverse consequence on sustainability in terms of environment is because of air pollution, improper release of waste, and utilization of unrefined substances of raw material, data information, and energy. Sustainable green practices in manufacturing organizations drive the development of new products and services, strategies, and innovations that empower financial outcomes and prosperity of organizations while considering the natural resources, and regenerative limit (Calik & Bardudeen, 2016).

Business enterprises could be supported in developing economies by integrating capabilities to combine available resources in order to enter into the diversified markets rapidly and cost-effectively (Gurtoo, 2009). The author has discussed that a few reforms are needed to be addressed in a particular context as the economy is getting down for the last few years. In public sector organizations, the members should develop a mutual consensus for the subsequent accomplishment of the green objectives.

Keeping in view the fact and theoretical nature of Industry 4.0 in terms of implications and management, empirical research is recommended for study in which implementation of digitalization is accompanied by a conducive environment with the interaction of men and machine while considering the legalities, obligations, assurance and ethics (Tjahjono et al., 2017). The advent of the fourth industrial revolution, referred to as industry 4.0 and its applications in the manufacturing companies have guided another era for business organizations. It assures the upgrade in operational efficiency and effectiveness as well as amplifies the economic performance (Sharma et al., 2021). The implication of digitalization has a positive impact on environmental and economic performance. In terms of Industry 4.0, advanced digital technologies, including cloud computing, Internet of Things (IoT), big data analytics have emerged drastically (Li et al., 2020). Moreover, business innovation models, through the adoption of industry 4.0 (I4A), address both the challenges and opportunities for business entities (Müller & Däschle, 2018).

H1: Adoption of Industry 4.0 has a significant impact on Green Practices.

The innovation performance (IP) strategies determine the innovation management in a very easy, simple, pragmatic, and implementable way while handling the limitations of former frameworks of innovations. In absolute innovation management, the firm will embrace the innovation performance strategies that will subsequently develop the innovations as part of routine work in organizations in contrast to considering it as a standalone activity that should be overseen independently (Aslam et al., 2020). Green innovation is a mandatory part of acquiring a competitive advantage in sustainable supply chains to accomplish sustainability objectives. Notwithstanding, supporting SUS and GP development in supply chains through green innovations is a complicated network activity in which stakeholders are involved, and the need exists to share the information in an equivalent and sensible trade process (Zhou et al., 2020).

H2: Innovation Performance has a significant impact on Sustainability

The GP has been regarded as a sustainable business drive by the researchers. Moreover, the relationship among supply chain partners has a great impact on GP (Yang & Lin, 2020). A fair and reasonable distribution of power among farmers, retailers and consumers will permit reasonable economic returns to producers and fortify the social relationship with native end-users (Nakandala et al., 2020).

H3: Green Practices has a significant impact on Organizational Performance

Sustainability (SUS) problems have been investigated in various ways and settings. While discussing in terms of economic, social and environmental perspective, impacts of present and anticipated climate change and reasonable efforts towards sustainable production and consumption of low-fossil carbon energy framework are addressed and applied (Tseng et al., 2013) In this industrialization era, ecologists are worried about the climatic changes and consistently keen on finding out the reasons that can work with the progress towards sustainability for substantial OP (Ahmed et al., 2020).

H4: Sustainability has a significant impact on Organizational Performance.

Industry 4.0 (I4A) could have an empowering influence on feasible business plans of action, however, it can likewise be an inhibitor by further taking advantage of the potential outcomes of neo-classical business models (Man & Strandhagen, 2017).

H5: Adoption of Industry 4.0 has a significant impact on Sustainability

Organizations with developed R&D departments, collaboration with different stake-holders including competitors is a suitable way of further developing IP, particularly in eco-friendly areas. Unexpectedly, the coordinated effort likewise assists SMEs with minimal financial and informational resources in order to get new skills and competencies to change the technologies with alternatives, the plan of action or both, and foster green IP advance-ments more effectively and with lower costs (Calza et al., 2017)

H6: Innovation Performance has a significant impact on Green Practices

Nexus to the context, business consensus can be developed by inculcating the tech-nological realization among the supply chain organizations. More the wastes are reduced, the production will become more profitable. Conclusively, there is a need to introduce the digitalization concepts through innovation performance and smart industrial revolution like acquiring the solutions to handle the seven production wastes.
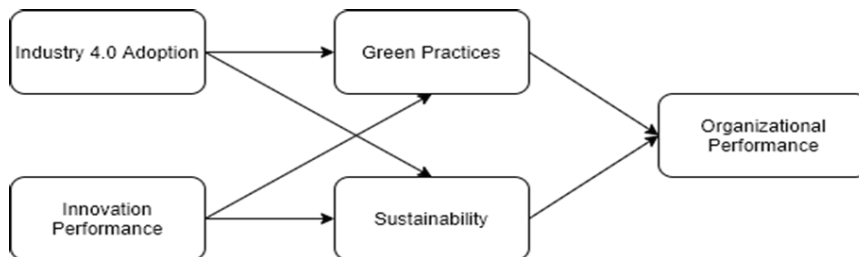
Figure 1: Organizational Performance chart

3.   Methodology

This is a descriptive study. The questionnaire was adapted from various resources mentioned in Table 1. Moreover, for content validity, the questionnaire was consulted with the experts of academia as well as practitioners and found appropriate.

3.1   Sampling Technique

The study has been carried out by floating the questionnaire to the respondents per-taining to the top, middle & lower management of different supply chain and logistics organi-zations from major cities of Pakistan i.e. Islamabad, Rawalpindi, Lahore, Faisalabad, Karachi and Multan. These were suppliers, manufacturers, whole-sellers, distributors, and retailers. It has been a good experience while consulting with stakeholders.

3.2   Instrument Adaptation

As the questionnaire was adopted, therefore, expert consultation was taken from 05 experts from academia as well as 05 senior practitioners performing their responsibilities in different organizations. During this process, the instrument was tested under the expert visionary analysis of the scholars as well as practitioners.

Table 1:
Instrument Source

Variables	Items	Source
Industry 4.0 Adoption	6	Chauhan et al. (2021)
Innovation Performance	7	Hussain et al. (2018)
Green Practices	4	Yacob et al. (2019)
Sustainability	4	Hussain et al. (2018)
Organizational Performance	3	Zhu et al. (2012)
	2	Hussain et al. (2018)

3.3   Validity and Reliability

The estimated Cronbach alpha for Green Practices is 0.750, Industry 4.0 Adoption (I4A) is 0.851, Innovation Performance is 0.888, Sustainability is 0.762 and Organizational Performance is 0.925. In the light of the results, it can be concluded that all the results are above the acceptance level (0.60 or 0.70), so all the items are internally consistent.

3.4   Sample Adequacy

The questionnaire was distributed to 27 Supply Chain and Logistics organizations. After the pilot testing, the results of all dimensions were found appropriate. The Cronbach's alpha values are 0.750 for Green Practices, 0.851 for Industry 4.0 Adoption (I4A), 0.888 for Innovation Performance, 0.762 for Sustainability, and 0.925 for Organizational Performance which shows the sample reliability and adequacy. About 500 questionnaires were floated both online and in hard copies. However, only 297 responses were received, so the response rate is 59.40%. The questionnaire was distributed to the directors, deputy directors, senior managers, middle managers, and executives of manufacturing organizations including textile, plastic, leather, pharmaceutical, and FMCG. The respondents were male and female members of the organizations. The age group was formed in three categories of 'less than 25 years, '26 to 35 and '35 & above'. Qualification of the respondents was minimum intermediate and maximum PhD along with minimum job experience of two (02) years. The questionnaire data were obtained from the employees working in organizations situated in Karachi, Lahore, Faisalabad, Multan, Rawalpindi, and Islamabad.

4.   Data Analysis

The descriptive analysis was carried out with respect to the induction of "Green Practices and Sustainability" as mediators. It has been observed that GP has a significant impact on OP, I4A has a significant impact on GP, I4A has a significant impact on SUS, IP has a significant impact on SUS, GP has a significant impact on OP, SUS has a significant impact on OP and I4A has a significant impact on GP. However, the results have shown that IP remained insignificant upon GP which means that Innovation Performance does not enhance the Green Practices. After the collection of data through questionnaires both floated online as well as by hand / hard copies, Smart-PLS has been used for data analysis.

4.1   *Measurement of Model*

4.1.1   *Reliability testing*

Reliability can be referred to as consistency. The reliability has been measured while using the composite reliability. It provides a better measure of internal consistency, besides Cronbach's alpha (Hair et al., 2014). The composite reliability (CR) value for all latent variables is shown in Table 3. It is good to express that the CR value of the variables is found >0.7 (Hair et al., 2011).

Table 2:
Reliability Testing and Convergent Validity

Construct	Cronbach's Alpha	rho_A	P values	CR	AVE
Green Practices	0.750	0.759	0.000	0.841	0.570
Industry 4.0 Adoption	0.851	0.887	0.001	0.888	0.569
Innovation Performance	0.888	0.905	0.005	0.912	0.601
Organizational Performance	0.925	0.924	0.081	0.946	0.779
Sustainability	0.762	0.775	0.003	0.847	0.580

4.1.2   *Convergent validity*

As indicated by Hair et al. (2011), for convergent validity measurement, the AVE method is used. Also, it's limit ought to be 0.5 or more prominent, and variable loadings ought to be above 0.70 (Hair et al., 2014). In Table 2 the qualities AVE are higher than 0.5. It likewise shows the loadings of variables as most of the values are above 0.7 with the exception of two loadings in GP and IP. Notwithstanding, most of the loadings are more noteworthy than 0.7 and AVE has been tracked down acceptable while certain items from all factors were eliminated.

4.1.3   Discriminant validity

Table 3 shows the correlation matrix, which affirms the discriminant validity. One more way to deal with affirms discriminant validity is actually taking a look at the cross-loadings of items. The cross-loading of every item in its own construct ought to be more prominent than cross-loadings on other constructs (Hair et al., 2011; Hair et al., 2014). As indicated by Gefen and Straub (2005) and displayed in Table 4, there ought to be a distinction of 0.1 between the cross-loadings on its individual construct and loadings on other constructs.

Table 3:
Discriminant Validity

	GP	I4A	IP	OP	SUS
GP	0.755				
I4A	0.388	0.754			
IP	0.360	0.746	0.775		
OP	0.390	0.616	0.718	0.883	
SUS	0.355	0.450	0.450	0.445	0.762

4.2   Inner model measurement and hypotheses testing

When the outer model estimation is assessed, the data is examined for the inner model estimation (Henseler et al., 2009; Hair et al., 2011). The Partial Least Square (PLS) is utilized to test the theories by utilizing bootstrapping (Haenlein & Kaplan, 2004). A bigger number of sub-example (normally at least 5000) are drawn from the first information utilizing this resampling strategy (Hair et al., 2014). According to the results in Table 2, all AVE values are as per the threshold standard. Similarly, CR values of all variables are above 0.6 which validates the acceptance range. Cronbach's Alpha values being coefficient of normality have also been observed up to the mark i.e. 0.70.

In contrast to Cronbach's alpha, CR value doesn't expect that all indicator loadings are equivalent in the populace, which is in accordance with the functioning standard of the PLS-SEM calculation that focuses on the indicators dependent on their respective reliabilities during the model assessment. Besides, Cronbach's alpha is additionally touchy to the item numbers in the scale and for the most part, will, in general, belittle internal consistenc reliability. By applying CR, PLS-SEM can oblige diverse indicator reliabilities (Hair et al., 2014).

Table 4:
Outer Loadings

	Green Practices	Industry 4.0 Adoption	Innovation Performance	Organizational Performance	Sustainability
GP1	0.741				
GP2	0.779				
GP3	0.788				
GP4	0.710				
I 4.01		0.826			
I4.02		0.740			
I4.03		0.708			
I4.04		0.784			
14.05		0.716			
I4.06		0.746			
IP1			0.889		
IP2			0.723		
IP3			0.757		
IP4			0.866		
IP5			0.763		
IP6			0.658		
IP7			0.744		
OP1				0.687	
OP2				0.914	
OP3				0.931	
OP4				0.917	
OP5				0.939	
SUS1					0.688
SUS2					0.782
SUS3					0.799
SUS4					0.774

According to Hair et al. (2014), Table 3 represents the discriminant validity of all variables is well adjusted which indicates the extent that empirically, every construct is different from other constructs or, in other words, the measure of the construct that is intended to measure. Table 4 values show the appropriate values of convergent validity that confirm the outer loadings of each item is above 0.70 when the average variance extracted (AVE) of each construct is 0.50 or higher (Hair et al., 2014) except IP6, OP1, and SUS1. However, values above 0.60 are also somehow acceptable.

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4.2.1   Hypotheses testing

According to the results shown in Tables 5 & 6, there is a need to transform the manufacturing companies into smart factories. Moreover, the purpose of this transformation is to get the benefits of green supply chain management. The study investigates the impacts of two dimensions of I4A and IP on social, economic, financial, and operational, from both a contingency and a configuration perspective.
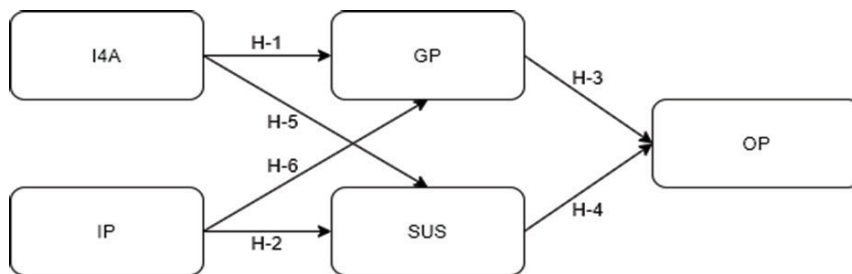
Figure 2: Hypotheses testing

According to the contingency viewpoint, we applied SEM to calculate the effects of individual factor dimensions and their interactions on organizational performance. According to the configuration viewpoint, we applied cluster analysis to foster examples of I4A and IP with the mediation of DP & SUS, which were analyzed in terms of OP perspective. The data was collected from SCM and logistics-related manufacturing companies to test the hypotheses. The results from both the contingency and configuration perspective show significance validation which was related to overall organizational performance.

Table 5:
Path Coefficients

	Original Sample (O)	Sample Mean (M)	St Dev (STDEV)	T Stats (|O/STDEV|)	P Values	Results
GP -> OP	0.266	0.266	0.062	4.320	0.000	Supported
I4A -> GP	0.269	0.270	0.084	3.215	0.001	Supported
I4A -> SUS	0.259	0.260	0.091	2.833	0.005	Supported
IP -> GP	0.159	0.164	0.091	1.745	0.081	Not Supported
IP -> SUS	0.257	0.262	0.085	3.007	0.003	Supported
SUS -> OP	0.351	0.355	0.049	7.143	0.000	Supported

In this research study, there are six (06) hypotheses. These have been examined through structural equation modeling (SEM). The results of the tested hypotheses have been shown in Table 5 (Fig. 'C'). The results of Hypothesis '1 to 5' are in accordance with the previous research (Chauhan et al., 2021; Hussain et al., 2018; Zhu et al., 2007). However, some have not been revalidated for Hypothesis 6.

Table 6:
Quality Criteria

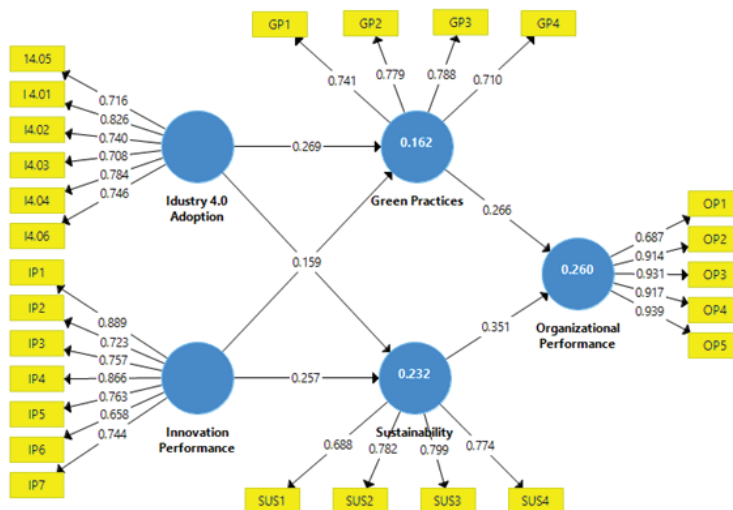|	R Square	R Square Adjusted
Green Practices	0.162	0.156
Organizational Performance	0.260	0.255
Sustainability	0.232	0.227

Figure 3: Organization Performance Research Model

The IP is not a significant predictor of GP which shows that results are not in accordance with the previous studies (Ahmed et al., 2018; Cousins et al., 2019; Li et al., 2021; Lin et al., 2014; Luu, 2020; Perez-Valls et al., 2016; Yacob et al., 2019; Yu & Ramanathan, 2015). However, revalidation of previous studies has revealed that IP has a significant relationship with the GP and OP (Luu, 2020). Moreover, the relationship of GP with OP is found consistent with previous literature (Ahmed et al., 2018; De Giovanni & Cariola, 2021).

5.   Discussions and Conclusion

As per the viewpoint of DiMaggio and Powell (1983), Institutional Theory drives the reason to the systematic analysis of innovation, utilizing various aspects of theories about the formal and casual establishment of relationships, just as the various levels of organizations (Geels, 2010). Besides, the Principle of Continuous Creation says that business as an organization is a value creation institution, therefore, the theory is required for a discipline to develop (Defee et al., 2010). Consequently, the I4A (Adoption of industry 4.0) idea in business becomes most significant and adaptable. While the institutional theory is discussing persistence and stability, digitalization concepts are connected with rapid, and some of the time problematic, societal and organizational changes.

Reliability means that the organizations are conforming to the realization for the adoption of I4A as a mandatory requirement. These elements including IP, GP, and SUS have both financial and non-financial impacts upon the performance of the organizations. In order to respond and comply with external pressures to adopt green supply chain management, focal firms have to collaborate with smart process activities and monitor the thresholds to further back up the supply chain to achieve the wholesome effect (Ahmed et al., 2020). The author has investigated various scientific theories in the study. It is concluded that lack of technological competencies and lack of willingness towards implementation of process innovation are the major obstacles to the adoption (Ahmed et al., 2018; Li et al., 2021; Luu, 2020; Yacob et al., 2019; Yu & Ramanathan, 2015).

According to the author, I4A has an influential role in the progression of business in a sustainable manner because when a company moves to strengthen its supply chain, hence, I4A is the one in which the business can grow at the optimal level. Industry 4.0 has a greater scope of responsibility in the automotive industry sector for its application and adoption as compared to other sectors. Same has been endorsed empirically that innovation performance and market ideas when applied through industry 4.0 make the enterprises more competitive (Ungerman et al., 2018).

A comprehensive study is discussed based on the literature that elaborates the importance and challenges of I4A with respect to SUS in four different perspectives: operations and technologies, implementation, integration, and compliance with respect to organizational long-run objectives. The results of the study posed both positive and negative dimensions of inflows and outflows with brief explanations of raw material, information and energy consumption and disposal of product and waste respectively, with a predominance of positive influences as derived from I4A (Bonilla et al., 2018). There is no evidence about the presence of an applied SCM that defines the theoretical constructs and role of I4A. However, conclusive findings have revealed that I4A has an effect on digital supply chains, driving the proposition for a reasonable model which addresses the flaws of prevailing interconnectivity between various components in order to curb the seven wastes. The purpose of our review was to investigate the effectiveness of SUS in supply chains (i.e., collaboration and assessment). In this regard, the impact of I4A has been tested with respect to buyer and seller social performance. The results have suggested that collaboration enhances the sellers' social performance whereas buyers' social reputation is the advent of buyers' social reputation (Sancha et al., 2016). The same has been revalidated in this study.

Results have become more interesting with the inclusion of GP and SUS as mediating variables. The results suggest that there is a strong relationship between I4A and OP in the presence of GP and SUS as mediating variables. Conclusively, the results show that the model is significant. It is commented that corporate decision-makers should equip certain digital parameters to the companies to produce innovative products for the customers. This is a comprehensive overview of the sustainable supply chain partners how they perform the transactions with green practices. Moreover, it has also been studied that a greater number of products used require sustainable aspects. However, some areas are not sustainable as they are neglected and there is a variation in the regions overall as well as the nature of the products. The sustenance can be achieved by effective communication among the manufacturers. Further, sustainability as a relationship may contribute internationally to a good flow of products in the global market.

In this study, I4A and its impacts on GP, SUS, and OP have been studied how these can be strengthened through IP and SUS. Moreover, how green digitalization has a significant impact on the overall performance of firms, so in the light of this result, it can be argued that I4A is one of the important elements of study. For the reliability of the questionnaire, a test run and the results of Cronbach's Alpha are more than 0.70 which indicates that there are no issues with reliability. Unfolding the results' argument, leading manufacturers in developed countries have already adopted the implementation of I4A and have high levels of awareness. However, it is uncertain how such practices are implemented (Scur & Barbosa, 2017).

Nexus to the above results we can narrate that organizations should take all necessary action for the industrial revolution, green innovations, and sustainable developments among the manufacturers because said characteristics have a significant positive impact on economic, operational, and environmental performance. Thus, there will be an enhancement in production and waste reduction which will ultimately result in efficient outputs. The results have revealed that a moderate level of positive resorptive capacity inappropriateness is the best option for companies to upgrade their supply chain networks' convergence (Roldán Bravo et al., 2020).

5.1   Implications

This research study has the following implications which can benefit suppliers, this research study has the following implications which can benefit suppliers, manufacturers, purchasers, and academic institutions.

5.1.1   Academic Implications

Institutions are the producers of efficient engineers, technicians, managers, entrepreneurs, and professionals who apply management theories for the resolution of business problems. When academia trains these participants or stakeholders of organizations professionally and innovative manner, the academic constraints of industry 4.0 and sustainable green practices play a pivotal role in producing quality scholars for the society which subsequently increase the goodwill of the respective institution. The effect of adoption of digitalized industrial adoption is an important area of research within studies of business organizations for efficient production levels. In the case of academia, these are terms as the smart factories of efficient professionals to the organizations who are the end-users as qualified producers. Moreover, academia is proposed to focus on digitalization for the upcoming industry 5.0 arena and encourage the research environment to mitigate the problems of supply chain stakeholders. This approach will lead academia into socially benefitted organizations.

5.1.2   Managerial Implications

The concept of smart manufacturing is associated with implications of I4A. Managers learn more in a conducive and innovative environment. The study revealed that a smart manufacturing environment favors the managers to produce better and control losses. During data collection, managers indicated that adoption of industry 4.0 drives the fulfillment of organization objectives exclusively when designed for the purpose. This evidence infers the reason why a lack of empirical studies failed to support the impact of innovation performance on green practices. Most of the respondents pointed out the economic perspective as a precursor of I40 implementation. Conclusively, I4A is productive when aligned with organizational objectives. Secondly, managers should analyze the return on investment factor of I4A.

Thirdly, the company's strategic position in the market should be considered in long run and both explorations and exploitations should be focused on to get optimal benefit.

Innovative interests and technological determination in I4.0 should be co-planned with the manufacturing companies. Managers, in some cases, perceive that, when the innovation is there, they will figure out how to make it work, yet these experimental outcomes obviously show that this isn't true. Then again, given the novelty of I4.0 adoption, it might take excessively yearn for an organization to truly set itself up to make the investments. Thusly, technological investment and changes in the companies should be co-created, while utilizing solid support and contribution from the functioning jobs.

A subsequent point is that organizations ought to appropriately assess the development of their association, with explicit consideration paid to organizational structure, professionalism and abilities. Running an appropriate authoritative appraisal, other than being helpful speculation, is basic for assessing people's genuine capacities to manage new methodologies, just as the degree of venture needed to fill skilled holes.

Lastly, organizations ought to consider making a coordination job inside the companies to outline all socio-specialized advancement projects – ensuring appropriate arrangement among the diverse authoritative units that are rational with organization technique.

5.2   *Limitations of the Study*

The limitations of this study must be accredited. Firstly, data was gathered from 297 respondents whereas primary data is always subject to biaseness up to some extent. Secondly, limited numbers of supply chain companies including textile, leather, FMCG, and plastic (only 19) were incorporated in this study; however future researchers can extend the generalization of the study to other sectors. Thirdly, time constraint was a major issue. The response rate was about 29.70%.

5.3   *Conclusions & Recommendations*

The research study has identified various factors to address the business solutions and has typically been focused on the identification of technological enhancement tools for the betterment of process and production in supply chain organizations through an analytical assessment of sustainability in the presence of green practices and digitalized platforms.

Implementing I4A can help to materialize the demand through appropriate determination and smart manufacturing. I4A refines data information, automates manufacturing processes, and transforms the inputs to profitable outcomes. For sustainable developments, manufacturing companies are recommended I4A and digitalized innovations to improve their

operational, environmental, and economic performance. It ought to be perceived that operational activities in the current business environment are profoundly information-intensive. Firms that get exact and concurrent information would thus be able to have prevalence in the competitive markets. I4A is essential for collecting and handling data information as well as production framework, conclusively supporting decision-makers adequately and proficiently.

For optimal economic, operational and environmental performance, organizations will have to adopt digitally-enabled technologies and infrastructure. In this research, we investigate the value creation of I4A and advancements in adaptable manufacturing under a sustainable and green perspective. I4A is an effective solution that Western manufacturing companies take on to confront rivalries from low-cost producers. Organizations taking on I4A use smart concepts and digital technologies to transform manufacturing processes automated and more adaptable. Conclusively, it is evident that I4A drives towards higher usefulness and better production outcomes, further developing the economic portray of organizations much presentable in the production index.

5.4   *Future Research*

For future directions, in addition to the proposed research model, there should be the identification of barriers (challenges) that resist the organizations to implement industry 4.0 technologies for economic, social, and environmental sustenance. Secondly, a feasible way out for handling the seven wastes (overproduction, inventory, motion, defects, over-processing, waiting, and transport) in lean production through digitalization is recommended. Lastly, appropriate parameters for the enhancement of capacity building of potential manpower are realized for further exploration through implications of circular economy in a sustainable environment.

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Industry-wise Sentimental Herding:
An Application of State-Space Model in Pakistan

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Abstract

In recent decades, the worldwide consecutive catastrophes in the financial markets emphasize the accelerating prominence of investors' sentiment on the financial market. Therefore, within academia, a shift from conventional finance to behavioral finance can be noticed and the most eminent topic of interest is the exploration of herding behavior. Inspired by the ongoing altercation on the magnitude and presence of herding in the stock markets, the present study aspires to explore the Pakistan stock market concerning herding behaviour. Investors' industry-wise market-based herding behavior in the Pakistan stock market has been examined by employing daily data obtained from Bloomberg starting from January 2000 to April 2016. Cross-sectional variabilities in the factor sensitivities (Beta) have been employed to estimate investors' sentimental herding behavior, following the model of Hwang and Salmon (2004). The study found herding to be significant and persistent, independent from market fundamentals, like levels of market returns and volatility of returns. Findings also show that investors do herd considering the industrial classification of financial assets; hence it leads to mispricing of stocks. The study also presents industry differences in herding. Sugar and banking sectors are found to be more prone to herding while textile and manufacturing sectors are found less prone to herding. The results entail cogent implications for the investors pursuing diversification in the Pakistan stock market.

Keywords: State-space model; herding behavior; sentimental herding; market returns; market volatility.

JEL Classification: H54, R53

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1.   Introduction

Behavioral finance has been an emerging trend within the financial literature as it co-alesces investors' emotions and thoughts in the stock market investment decision. Investment decision-making is a complex contrivance assimilating diverse concepts including the return, time, risk, and other factors. The investment decision is a versatile decision-making process that is unique; however, distinguished diversely by different types of investors. Stock market behavior can be contemplated as a reflection of investors' attitudes towards multiple factors. Conventional finance theories regard humans as rational agents. Whereas, behavioral finance theories emphasize the cognitive, social, and emotional factors of investors. As human re-actions are the outcomes of various events, behavioral finance theories provide the realistic specification of clustered market volatility. Hence, the behavioral aspect of market anomalies depends on social and psychological aphorism where the investors are regarded as the vic-tims of cognitive biases and errors (Litimi, 2017). Perhaps, excessive volatility is emanated from volatile beliefs and emotions and is persistent as long the investors exhibit erroneous pitfalls (Litimi, 2017).

Investment decisions are primarily grounded on the investors' expectations about risk and returns. However, conforming to herding behavior investors either due to inappropriate information or due to limited capital or confused status of the market, sometimes follow other collective investors blindly and ignore the market fundamentals which results in mispricing of underlying assets. Simultaneous buy (sell) of the same stocks following the buy (sell) of others is regarded as herding (Espinosa-Méndez & Arias, 2021; Lakonishok et al., 1992).

Herding behavior can create market bubbles which ultimately eventuate in market disequilibrium and generates exaggerated volatility. This behavior is often impelled by cer-tain psychological components, for instance, confidence in the stock price increase, wishful thinking, influence of other investors' judgments as well as pressure to adapt (Bikhchandani & Sharma, 2000). Substantial mispricing and risks in the financial market can be the result of herding behaviour and the instances of these can be the global financial crisis (GFC) and the impact of the COVID-19 pandemic in different financial markets (Chang et al., 2020; Espinosa-Méndez & Arias, 2021). The herding phenomenon has been also observed during the regime of the information technology (IT) bubble (2000-2002) (Choi & Yoon, 2020). Therefore, the detection of herding behavior bears significance which can challenge the con-ventional rational theories of investment (Choijil et al., 2022; Lao & Singh, 2011).

One of the preliminary works covering herding behavior is the study of Christie and Huang (1995), who used the Cross-Sectional Standard Deviation (CSSD) of returns as a method of individual asset returns' average proximity to the realized market returns. Their work was extended by Chang et al. (2000) who modelled the nonlinear relationship between the Cross-Sectional Absolute Deviations (CSAD) of returns and market returns.

Nevertheless, Hwang and Salmon (2004) criticized Christie and Huang (1995)'s model as their methodology only accounts for intense market returns, either positive or negative, it is subjective and can be best in defining extreme situations. Moreover, employing positive and negative dummy variables for positive and negative CSSD stock returns will result in strong correlation which ultimately affected the model to identify whether these changes are due to result of herding. Hence, the arguments of Hwang and Salmon (2004) weakened the Christie and Huang (1995)'s approach, considering herding as a result of investors' unobserved sentiments, they applied a state-space model to impart herding behavior empirically towards the market.

To understand the herding behaviour' existence in the financial markets, through the application of various methods, many studies have reported interesting empirical results from Asia (Chong et al., 2020; Yousaf et al., 2018; Zheng et al.,2017) and Western contexts (Litimi et al., 2016; Pochea et al., 2017; Stavroyiannis & Babalos, 2020). However, the findings do not yield identical empirical consensus or results concerning the existence of herding behaviour. While continues appeal from the previous research has indicated the importance of exploring herding behaviour constituting different industries from various nations with the suitable model application (Ahmed et al., 2019; Dewi & Candraningrat, 2019; Choi & Yoon, 2020; Chong et al., 2020; Stavroyiannis & Babalos, 2020).

In Asia, as an emerging stock market, focussing towards Pakistan stock market, the herding behaviour has been captured in diverse studies in this decade (Jabeen, 2019; Javaira & Hassan, 2015; Javed et al., 2013; Jhandir & Hanif, 2014) applying the criticized methodology of Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010) as well as lacking focus on industry-wise herding in Pakistan stock market. Although Ahmed et al. (2019) recently studied this practice in the Pakistan stock market; however, the data coverage of this study is minimal. Furthermore, due to the fallacious formulae (modified herding proxy for mathematical easiness) to capture this behavior, the actual scenario is not reflected. Therefore, studies are encouraged (Ahmed et al., 2019; Choijil et al., 2022; Jabeen, 2019) to learn more about herding behavior in the Pakistan stock market. The truancy of austere research in Pakistan has motivated the researchers to inspect this phenomenon further intensely into the diverse prominent sectors instead of the overall market.

Hence, the present study endeavors to examine the industry-wise market-based herding behavior of investors in the Pakistan stock market using the conducive Hwang and Salmon (2004) methodology of State-Space model covering data for a long period (2000-2016). Financial, textiles, fuel and energy, sugar, and manufacturing industries are examined to broaden the understanding concerning herding behavior.

The contribution of the study entails controlling the effect of market return, volatility, and financial crisis. This study further discusses the conceivable implications of various

industry-wise herding levels in the Pakistan Stock Exchange (PSX). To get a better understanding of the functioning of the market, this study thus can provide insights on the herding practice which can eventually aid the academicians as well as practitioners in understanding market efficiencies and anomalies. Based on the nature of herding persuasion, this can help in providing more precise valuation, estimation, and risk perception in investment decision making.

The remaining of this paper is as follows: Section 2 describes the relevant literature on herding behaviour; the methodology of this study is discussed in Section 3; Section 4 delineates the results; finally, concluding remarks together with implications and future research directions are discussed in Section 5.

2.   Literature Review

This section strives to discuss herding behaviour literature from the global as well as Pakistan perspective. Various methodological differences and findings can be ascertained from the following discussions.

2.1   *Herding Behavior*

Conventional economics and finance investment theories like Expected utility theory (EUT), Capital Asset Pricing Model (CAPM), Efficient Market Hypothesis (EMH), Modern portfolio theory (MPT), and Arbitrage Pricing Theory (APT) consider humans as a rational economic agent. It also presumes that the investors' investment decision is essentially based on the trade-offs between risk-returns. Despite their continuous application in investment decisions (Apergis & Rehman, 2018; Dellano-Paz et al., 2017; Kisman & Restiyanita, 2015; Zabarankin et al., 2014) these theories are repeatedly criticized for their frailty in reflecting the multifaceted attitudes and preferences of investors. Besides, irrational behavior by the small individual investors has been noticed in practice meaning, certain investors while encountered with new information, do not respond rationally (Belhoula & Naoui, 2011).

Consequently, behavioral finance literature started to argue with various models and theories to aid in understanding investment behavior and decision making. While exploring these behavioral factors, herding behavior came to the light of the literature. Based on either private or public information or knowledge about other investors' behaviour, investors tend to mimic them (Chang et al., 2020) subsiding their own beliefs and judgment. Thus, following the market sentiment primarily relates to herding behaviour (Choi & Yoon, 2020). While discerning the herding behavior, most of the studies primarily depend on diverse models like Cross-Sectional Standard Deviation (CSSD), Portfolio Change Measure (PCM), State-Space Model, Cross-Sectional Absolute Deviation (CSAD), and Lakonishock et al. (1992) (LSV) model (Chang et al., 2000; Christie & Huang, 1995; Hwang & Salmon, 2004; Lakonishok et al., 1992).

Various researchers have strived to explain the causes of herding behaviour among investors. For instance, according to Bikhchandani and Sharma (2000), three explanations can be detected for herding behaviour including reputation-based, informational cascades, and compensation-based. Reputation-based herding can be espied among the fund managers who want to assure their reputation by following other fund managers' decisions due to the inconsistency between their private and public information (Graham, 1999). Informational cascade refers to the investors' following the previous decision makers' preferences in making their own decisions. Compensation-based herding, on the other hand, indicates the herding behaviour among the fund managers whose compensation depends on their performance and this leads them towards herding (Bikhchandani & Sharma, 2000). Herding behaviour can also be expressed in different forms namely, trading in the unidirectional form with others, following the previous trends, imitating or correlating the behaviours with others, etc. (Kyriazis, 2020). Thus, it is imperative to delve into the herding phenomena for a better understanding of the financial markets.

2.2   *Herding Behaviour: A Global Outlook*

Worldwide the herding behaviour utilizing divergent methods has been producing mixed results incorporating distinct factors. For example, Bekiros et al.(2017), in an exploration on the USA market using the CSAD approach found intense herding under intense market conditions where the impact of volatility is also noted for the irrational behaviour. Benmabrouk (2018), while investigating this behaviour within the crude oil and stock market including market volatility and investor sentiment in NASDAQ100 and VIX index (2000 to 2016) depicts the reduction of herding by volatility influence. Additionally, a lack of sufficient information fuels this practice. They used both CSSD and CSAD to come up with such results. Similarly, BenSaïda (2017) expresses that during the turmoil periods, in most of the sectors of the American stock market herding existed intensely. The studies that modified the CSAD model depict the impact of volume turnover and herding on conditional volatility.

Among Latin American and Asian markets, China, Malaysia, India, Singapore, Brazil, and Argentina do not display any nonlinearity (Kabir & Shakur, 2018). The findings were obtained by utilizing the Smooth transition regression (STR) to study these two regions' herding behaviour. During the market stress, volatility is the prime reason for herding rather than fewer returns. Furthermore, Zheng et al. (2017) found evidence of intense herding within the financial and technology industries, in the Asian markets whereas, within the utility industry it was relatively weaker. Litimi (2017) conducted a study to learn about this practice in the French stock market. His study used CSAD and Generalized autoregressive conditional heteroskedasticity (GARCH) models including investors' sentiment and trading volume. The herding existence is depicted during the crisis period particularly for certain sectors for the entire time. Additionally, this behaviour has an impending impact on the market's conditional volatility. From the context of Central and East European (CEE) countries, except for

Romania and Poland, herding is observed (Pochea et al., 2017). This study was conducted using the Chang et al. (2000) model and quantile regression analysis (QRA) model for the period 2003-2013 and herding behaviour is detected in the market up and down periods.

Moving towards the Korean context, the KOSPI and KOSDAQ stock markets herding behaviour were studied by Choi and Yoon (2020) employing the quantile regression method and CSAD approach covering the data from 2003 to 2018. Their findings relate to the herding behaviour during extreme and down-market conditions. The study also confirms that investors' sentiment is a prime reason for herding behaviour. The application of the Cross-Sectional Dispersion Approach (CSDA) was identified in a study by Economou et al. (2018). This study was conducted in the financial markets of the UK, USA, and Germany and implies the influence of fear on herding behavior. Hudson et al. (2020) used Hwang and Salmon (2004)'s model and found that institutional investors' sentiment is a significant factor of herding behavior in the UK. Mutual fund managers specifically herd on size, portfolio, and value factors. Interestingly, sentiment factors affecting herding behavior are different among closed-end and open-end fund managers.

In the Indonesian capital market (LQ-45 index), using Vector Auto Regression (VAR) method for the period of 2013 to 2016, Dewi and Candraningrat (2019) assert that the type of investor is an influential factor in herding behaviour. Herding behaviour is also evident in the stock markets of the Islamic Gulf Cooperation Council (GCC) (Chaffai & Medhioub, 2018). This study used Chiang and Zheng (2010) model, GARCH, and QRA to express that herd information is negative during the upward trend of the market which follows the movement found in Japan, China, and Hong Kong.

The appearance of herding is even detected in the cryptocurrency market according to the findings of Silva et al. (2019) who adopted CSAD, CSSD, and Hwang and Salmon (2004) for their study conducted for 2015 to 2018. Analysts' market sentiments and herding behaviour have been captured by Chiang and Lin (2019) and the results show that the analysts' lean-to heard while issuing recommendations and this impulse accelerates with market sentiment. Conversely, in all USA stocks (2000 to 2017) the altered CSAD model demonstrates the absenteeism of herding in all sectors (crude oil and stock market) (BenMabrouk & Litimi, 2018). Additionally, fear sentiment reduces herding tendencies. Equivalently, according to Stavroyiannis and Babalos (2020), within Eurozone stock markets (2000-2016) negative herding (anti-herding) behaviour is observed. Consequently, herding behaviour research has a long way to proceed with compelling aspects.

2.3   *Herding Behaviour: Pakistan Perspective*

Herding behavior studies from the Pakistan stock market provide highly mixed results. For instance, Javed et al. (2013) explored the monthly yields of the Karachi Stock

Exchange (KSE) for 8 years using CSSD and CSAD of returns but did not account for volatility which sometimes may overlap herding. No herding evidence was there in KSE for their studied span. The potential reason behind this was methodology as well as the period they use. They used Christie and Huang (1995) and Chang et al. (2000) methods, also the sampling period might be comprising normal market situations. A similar methodology was used by Javaira and Hassan (2015) to investigate herding behavior in the Pakistan stock market from 2002 through 2007 using daily and monthly returns of stocks from KSE100 claiming non-existence of herding behavior.

Jabeen (2019) while exploring the herding behaviour (1998-2018) with Chiang and Zheng (2010)' model in PSX involving 528 listed firms' daily closing prices established the lack of presence of herding behaviour in PSX with exceptions in certain sectors. Correspondingly, Kiran et al. (2020) detect no herding for the span of 2004 to 2017 within the PSX involving 663 listed companies. They used Christie and Huang (1995) and Chang et al. (2000) models for the estimation. The lack of existence of this behaviour can be due to the belongings of these firms to various sectors that follow the respective industry portfolio rather than the overall market. Another study (Shah et al., 2017) on PSX describes that individual companies do not herd usually concerning market index apart from experiencing negative returns. However, when large companies face extreme market movements, they do herd. They covered the herding behaviour for the period of 2004 to 2013 constituting 609 listed companies.

Conversely, Jhandir and Hanif (2014) used CSAD of returns to capture herding behavior around the macroeconomic announcement. They employed daily data of 249 listed firms with the period of 2003 to 2013. They concluded that herding in Pakistan was prominent around policy rate and inflation rate announcement but not prominent around budget, fuel price, and industrial production announcement. Similarly, herding exists in the Pakistani Stock market during the bearish and bullish market (Malik & Elahi, 2014). A study conducted by Ahmed et al. (2019) in Pakistan utilizing Hwang and Salmon (2004) model finds the existence of herding behaviour between 2013 and 2018 with the intensity of herding within the cement industry. However, the period covered in this study is quite limited. The survey of Qasim et al. (2019); however, entails that investors' decision making in the Pakistan stock market is highly influenced by overconfidence biases and herding. Yousaf et al. (2018) tried to capture this practice within the Pakistani stock market with particular focus to crisis period and Ramadan effect covering data from 2004 to 2014 using Christie and Huang (1995) and Chang et al. (2000). They delineate herding's presence during low trading volume days with its absence during the period of Ramadan. Whereas herding behaviour is found amidst the global financial crisis as information asymmetry and higher uncertainly were conceived by the market participants.

In a nutshell, it can be said that the difference in findings in capturing herding behaviour globally can be due to the different factors and methodological differences as bounteous studies have been utilizing either the Christie and Huang (1995) or Chang et al. (2000) models which have limitations in absorbing the herding in normal periods whereas reporting herding behaviour's existence in extreme situations. Therefore, Choi and Yoon (2020) invited academia to explore the investment sentiment from various stock exchanges to learn about the factors behind this tendency. Moreover, increasing criticisms about mainstream finance doctrines in explaining financial market rigidities, fluctuations and abnormalities have led the doors open for discussion about one of the core areas of behavioral finance, specifically herding behavior (Syriopoulos & Bakos, 2019). Emerging markets seemed to be more prone to herding behaviour due to the incentives and market participants characteristics compared to the developed markets with more professional peers. Hence, there are rooms for exploration to know about the herding behaviour from the developing and emerging countries' contexts (Choijil et al., 2022; Economou et al., 2018).

Therefore, it is deemed necessary (Chiang & Lin, 2019; Choi & Yoon, 2020; Jabeen, 2019) to explore this behavior with a more comprehensive Hwang and Salmon (2004)'s State-Space model of Beta herding to detect herding. Thus, employing the State-Space model into the Pakistan stock exchange (PSX) along with the industry-wise level will allow this study to capture herding more comprehensively as this State-Space model does not rely only on the deviation of returns but also accounts for systematic risk present in the market. Besides, the use of CAPM and CSSD to apprehend comprehensive findings on market return, volatility, and financial crisis make the present study literature enhancing.

3.   Methodology

3.1   Method

This study utilizes Hwang and Salmon (2004) model for the estimations. This model provides emphasis on the sentiment of investors which moves in alliance with the risk indicator beta. This model used the cross-sectional behavior of assets similar to Christie and Huang (1995). Despite this, their model was different as in market-wised herding they used betas of individual stocks instead of returns. Perhaps, in market-wide herding, investors clinch to pursue market trends and this ultimately results in the co-movement of individual returns and market returns in the same direction.

As time passes, sentiments of the investor may vary, which will result in a change of the beta value of the stock from the investors' constant initial value and converging to market beta of unity.

Hwang and Salmon (2004)'s model is grounded on an association between biased beta (β^b_{imt}) which is observed and unobserved true beta (β_{imt}) as follows:

$$\frac{E^b_t(r_{it})}{E_t(r_{mt})} = \beta^b_{imt} = \beta_{imt} - h_{mt}(\beta_{imt} - 1) \dots\dots\dots\dots\dots\dots\dots(1)$$

Where $E^b_t(r_{it})$ is the biased short-run conditional expectation on the excess returns of asset I at time t. Additionally, $E_t(r_{mt})$ is the expectation of the market's return at time t. The unobserved herding behavior indicator h_{mt} is the parameter postulated proportional to the deviation of the individual true beta from market beta unity. The cross-sectional variation of β^b_{imt} becomes:

$$Std_c(\beta^b_{imt}) = Std_c(\beta_{imt})(1 - h_{mt})\dots\dots\dots\dots\dots\dots\dots(2)$$

Taking logarithms of both sides of Eq. (2), we get,

$$\ln[Std_c(\beta^b_{imt})] = \ln[Std_c(\beta_{imt})] + \ln(1 - h_{mt})\dots\dots\dots\dots\dots (3)$$

We may now re-write Eq (3) as

$$\ln[Std_c(\beta^b_{imt})] = \mu_{mt} + H_{mt}\dots\dots\dots\dots\dots\dots(4)$$

Where $\mu_{mt} = \ln[Std_c(\beta_{imt})]$ is a postulated constant in the short time and $H_{mt} = \ln(1 - h_{mt})$. Hence, Hwang and Salmon (2004) allowed herding, H_{mt}, to comply a dynamic process AR(1), such that the system is as follows:

$$\ln[Std_c(\beta^b_{imt})] = \mu_{mt} + H_{mt} + \vartheta_{mt}\dots\dots\dots\dots\dots(5.1)$$
$$H_{mt} = \varphi_m H_{mt-1} + \omega_{mt}\dots\dots\dots\dots\dots(5.2)$$

Here, respectively the two error terms are $\vartheta_{mt} \sim iid\ (0, \sigma^2_{m\vartheta})$ and $\omega_{mt} \sim iid\ (0, \sigma^2_{m\omega})$.

The two equations in Eq (5) constitute the standard State-space model. In our estimation, Equation (5) is referred to as Model 1. Here, a key parameter of interest in Eq. (5) is the variance of the error term of the state equation $\sigma^2_{m\omega}$. When $\sigma^2_{m\omega}$ is zero, it entails that there is a lack of herding, since $H_{mt} = 0$ for all t. However, a statistically significant value of $\sigma^2_{m\omega}$ would mean the herding existence in the market. Additionally, a significant φ_m, if $|\varphi\_m| \leq 1$, would assist the autoregressive process. By comprising market returns and market volatility in the first equation of their model, Hwang and Salmon (2004) also assessed the robustness of the model. According to their argument, if H_{mt} turns into insignificant after the incorporation of the market fundamentals into their model, consequently changes in $Std_c(\beta^b_{imt})$ may be interpreted by market fundamentals instead of herding. Therefore, Model 1 can be adjusted to incorporate these market fundamentals as control variables to test for robustness as follow:

$$\ln[Std_c(\beta^b_{imt})] = \mu_{mt} + H_{mt} + \theta_{c1}\ln\sigma_{mt} + \theta_{c2}r_{mt} + \vartheta_{mt}\dots\dots\dots\dots\dots(6.1)$$
$$H_{mt} = \varphi_m H_{mt-1} + \omega_{mt}\dots\dots\dots\dots\dots\dots(6.2)$$

Where $\ln \sigma_{mt}$ and r_{mt} represent market volatility and log yield in time t. Hence, the two equations, 6.1 and 6.2 constitute our Model 2.

However, as our sample data involves the 2007-2008 global financial crisis (GFC), hence controlling the impact of this crisis in our model is equally important. Hence, our Model 3 has one more controlling variable namely, Financial Crisis Dummy for the last quarter of 2008.

$$\ln\left[Std_c\left(\beta_{imt}^b\right)\right] = \mu_{mt} + H_{mt} + \theta_{c1} \ln \sigma_{mt} + \theta_{c2} r_{mt} + \theta_{c3} D_{FC} + \vartheta_{mt} \ldots\ldots\ldots(7.1)$$

$$H_{mt} = \varphi_m H_{mt-1} + \omega_{mt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(7.2)$$

In Equation 7.1 of Model 3, D_{FC} refers to Dummy Variable for the last 3 months of 2008 controlling the effect of the Financial Crisis.

3.2   *Data and Beta Estimation*

The daily share prices for the listed firms in the KSE-All Index as well as the Index level were obtained from Bloomberg which provides us daily shares prices of 420 firms out of 554 listed companies. The daily data covers the dates between January 1, 2000, and April 28, 2016, providing us 4259 usable observations for each i firm.

Once we had betas, we then calculated the CSSD of betas for each month based on the following formula:

$$Std(beta)_t = \frac{\sqrt{\sum_{i=1}^{n}(beta_{it} - \overline{beta_t})^2}}{n - 1}$$

Where t represents the month, i represents the firm i, and $\overline{beta_t}$ represents the cross-sectional average of all betas in month t.

To control market fundamentals, monthly market log-returns were calculated as under:

$$R_{mt} = \log\left(\frac{Index_t}{Index_{t-1}}\right)$$

Where t represents the last day of each month of the sample data.
The volatility of market return has been calculated as follows:

$$\sigma_{mt} = \sum_{i=1}^{n}(R_{mi} - \overline{R_{mt}})^2$$

Where i represent the day in t month and R_miis daily market returns.

After obtaining those 196 monthly betas of all 420 listed firms, Industry-wise classification of PSX is applied and five prominent industries of financial, textiles, sugars, fuel and energy, and manufacturing sectors were identified at first descriptive statistics industry-wise and then Hwang and Salmon (2004) model of State-space was applied for sentimental herding.

4.   Results and Analysis

In this section, at first, the descriptive results of all firms along with industry-wise cross-sectional betas are shown. Then this study's Final Model 3 is presented for overall firms as well as for five sample industries.

Table 1:
Sample descriptive statistics of Cross-Sectional Std. (β^b)

	Std. Dev. of Betas	Log (Std. Dev. of Betas)
Panel A: Descriptive including 2008 Crisis		
Mean	1.67128	0.12478
Std. Dev.	2.08277	0.24664
Skewness	7.47779	1.29809
Kurtosis	67.3471	7.32167
JarqueBera	35641.1	207.572
Panel B: Descriptive excluding 3 months of 2008 Crisis		
Mean	1.375844	0.278427
Std. Dev.	0.403458	0.285719
Skewness	0.993271	-0.018760
Kurtosis	4.547244	3.412721
JarqueBera	50.98666	1.381128

The descriptive statistics of Panel B refers to the case when three months of crisis (October 2008 to December 2008) were removed, the period being an outlier, which was making our data distribution not Gaussian.

Table 1 depicts the descriptive statistics of Cross-Sectional Standard Deviation (CSSD) of Beta for all 420 firms. Panel A's results are showing that our data is not normal and visual inspection of the beta series highlighted the peak in the financial crisis of 2008. Panel B shows that excluding three months of crisis makes our distribution Gaussian thus further analysis may be followed according to normality assumptions. All the rest of the industries' descriptive statistics are shown in Table 2 below.

Table 2:
Descriptive statistics of observed Cross-Sectional Betas (β^b)

	Financial	Textile	Sugar	Fuel &Energy	Manufacturing
Mean	0.138861	0.11239	-0.05009	-0.10975	-0.030177
Std. Dev.	0.225962	0.244364	0.203925	0.167686	0.221904
Skewness	0.605042	0.197242	0.116561	0.65696	0.598115
Kurtosis	3.927184	3.346427	3.61578	3.449203	3.850593
JarqueBera	18.68864	2.21652	3.486308	15.50568	17.32556
Number of Firms in the Industry	87	137	26	20	45

In Table 2, descriptive statistics of observed Betas [bias beta due to herding; see Hwang and Salmon (2004) model stated earlier] are presented. Here, the mean log of betas for financial and textile sectors are positive whereas the sugar sector, fuel, energy, and manufacturing sector have a negative mean of log of betas. It may indicate that portfolio managers can achieve benefits of diversification easily if they include all types of industries in their portfolios. Moreover, only major industries are reported, miscellaneous groups or industries having less than 20 firms were discarded.

Method: Maximum likelihood (Marquardt)
Included observations: 196
Convergence achieved after 31 iterations

Table 3:
State-Space model regression with control variables (market return, volatility and financial

Variable	Coefficient	Std. Error	z-Statistic	Prob.	De standardized Co-efficient
μ	0.396602	0.103902	3.81708	0.0001	0.396602
φ	0.873738	0.05406	16.16246	0.0045	0.873738
σ	-2.23406	0.136097	-16.41520	0.0001	0.32725
σ	-3.60425	0.395467	-9.11392	0.0021	0.164948
θ_1 (Market Return)	4.326626	0.745173	5.80621	0.0034	4.326626
θ_2 (Market Volatility)	-1.49785	0.228719	-6.54885	0.0022	-1.49785
θ_3(2008 Crisis dummy)	2.348413	0.404053	5.81214	0.0010	2.348413
Log-likelihood					
σ $\log S\, t\, d\, \beta$	-99.9666	Akaike info criterion		1.091496	0.577307
Parameters	7	Schwarz criterion		1.208572	
Diffuse priors	0	Hannan-Quinn criterion		1.138894	

The maximum likelihood measures of the State-space model for the general industry are depicted in Table 3. The estimated value of the coefficient of state equation$\varphi_m$is statistically significant. The value of$\sigma_{m\omega}/\log Std\beta$ (signal to noise ratio) is 57.7%. The results also show that Std_c (β^b_{imt}) decreases with market volatility but increases with market returns. We may, therefore, conclude that Std_c (β^b_{imt}) decreases when the market

is more volatile and is descending. Similarly, the coefficient of σ_mω(standard deviation of the error in state equation) is as well significant. Therefore, the above results indicate strong testimony of herding in the PSX. The high value of "signal to noise ratio" indicates that the process of herding is exhausting. In the above table, we have reported model 3, which included the value of market return, volatility, and the dummy of the financial crisis of 2008. The signal to noise ratio of model 1 (not reported here) is 0.89. If we compare the signal to noise ratios between model 1 and model 3[1], the signal to noise ratio declines from 0.89 to 0.58, which relates that market returns and volatility are the partial contributors of herding behavior in the PSX. The overall results of Table 3 show the evidence of herding in the PSX.

Investors' sentiment is found to be a strong factor for herding behavior which is according to the findings of Choi and Yoon (2020) conducted in the Korean stock market. However, they used the CSAD and quantile regression method for the estimation. Kabir and Shakur (2018) and Benmabrouk (2018) also reported relevant results of the influence of the USA market sentiments on investors' herding practices. The herding is also robust as significant testimony of herding was found after controlling market fundamentals and 2008 GFC. These findings are aligned with Hwang and Salmon (2004) and Demir et al. (2014) Briefly, the results show that the herding behavior in PSX is not only significant but is independent of the conditions pertaining to the market.

Table 4:
State-Space Model regression with control variable of market return, volatility and financial crisis of 2008 (Model 3) for all the industries separately
Method: Maximum likelihood (Marquardt); Included observations: 196

Industry classes	Overall	Financial	Textile	Sugar	Fuel &energy	Manufacturing
Variable	DE standardized Co-efficient					
μ	0.3966 02	0.179011	0.171069	0.006274	-0.065762	0.003331
φ	0.873738	0.846462	0.890632	0.740366	0.871543	0.914182
σ	0.32725	0.168262	0.165472	0.166639	0.123927	0.172531
σ	0.164948	0.073033	0.072703	0.070994	0.053281	0.050667
θ_1 (Market Return)	4.326626	1.770271	2.142281	2.135592	1.531651	1.124806
θ_2 (Market Volatility)	-1.49785	-0.488842	-0.661407	-0.608195	-0.468338	-0.410326
θ_3(2008 Crisis dummy)	2.348413	0.894444	1.125189	1.187529	1.074103	0.425679
Convergence achieved after iterations	31	19	204	22	46	25
Log likelihood	-99.9666	38.86342	39.02989	46.46189	97.78593	43.67726
Akaike info criterion	1.091496	-0.325137	-0.326836	-0.402672	-0.926387	-0.374258
σ $\log S\,t\,d\,\beta$	0.577307	0.323209	0.297521	0.348136	0.317745	0.22833

[1] Model 1 was not controlling for any market fundamentals; Model 2 was controlling for Market fundamentals i.e. Market Return and Volatility and Model 3 were also controlling for 2008 financial crisis dummy along with Market fundamentals.

Table 4 shows the industry-wise results of our state-space model 3. The estimated values of all industry coefficients of state equation φ_m are statistically significant. Additionally, the coefficients of $\sigma_{m\omega}$ (standard deviation of the error in state equation) are indicated as significant in all the sectors. The results also show that $Std_c (\beta^b_{imt})$ decreases with market volatility but accelerates with market returns for all the industries. The value of $\sigma_{m\omega} / \log Std\beta$ (signal to noise ratio) is higher in the sugar sector, while the signal-to-noise ratio of the manufacturing sector is low. The rationale behind the higher herding effects (signal to noise ratio) in the sugar sector may be attributed to seasonal effects[2]. Another prominent herding is noted in the financial sector. The herding of the financial sector may be influenced by the monetary policy shocks, which create more signal-to-noise ratios as compared to other sectors. The herding in the oil and gas sector is the third-highest due to its signal-to-noise ratio among all the industries. The oil and gas sectors are mostly affected by the international crude oil price changes. The lower herding effect is found in the textile and manufacturing sector (real sector), which shows that these two sectors are stable in terms of herding behavior as compared to other sectors. The findings of Table 4 show that the evidence of herding is robust by one sector to another sector by industry effects.

Although, the influence of sentiment on herding behavior using various models has been noted in previous studies (Benmabrouk, 2018; Choi & Yoon, 2020; Kabir & Shakur, 2018), the present study affixes value to the existing herding literature base by adding additional compelling findings on sectorial herding behavior which may differ based on cultural, economic or other relevant factors. Furthermore, controlling for market return, volatility, and use of the dummy variable for Financial Crisis 2008 have made the study contribute to the literature with further insights. Market returns and volatility are the partial contributors to herding in Pakistan. Market volatility and its connection with herding conforms with Bekiros et al. (2017) and Benmabrouk (2018) in the USA and contradicts in the Turkish stock market (Cakan & Balagyozyan, 2014) and Argentina and Brazil stock markets (Kabir & Shakur, 2018). About market returns, the findings of partial herding in the PSX align with the USA stock market (Litimi et al., 2016), Indonesian stock market (Rizal & Damayanti, 2019) as well as Chinese stock market (Mahmud & Tiniç, 2018). Despite this, it must be noted that in Pakistan, herding due to market returns is relatively partial.

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[2] In Pakistan, raw material of sugar industry (sugar cane) is not available throughout the year. It is based on seasonal production of sugarcane.

4.1   Conclusion

Investors' herding behavior is obtaining continuous attention from various communities to understand their investment decision-making patterns. This study explores the investors' herding behavior in the Pakistan Stock Exchange (PSX). The State-Space model, as proposed by Hwang and Salmon (2004) is utilized to make herding observable. It has been argued that the measure of herding under this approach is preferable to other popular measures of herding, especially when investors' sentiments may cause herding under stress. The prime trigger for the investors in PSX to plunge into a cumulative herding movement varies sector-wise. Significant differences in industry-wise betas have been identified, hence investors may get the benefits of diversification by holding heterogeneous stocks in their portfolio.

The conclusive evidence shows that herding is significant and persistent in Pakistan across different industries. It means that investors are ignoring market fundamentals and following the market movements by imitating the other investors. After controlling for industrial differences along with market fundamentals of returns and volatility, herding evidence was detected. Findings indicate that market returns and volatility are the partial contributors to herding in Pakistan. In conclusion, it can be stated that instead of market fundamentals, investors' sentiments regarding the choice of stocks, specifically, their preference for the specific type of industry, may also be one of the prime contributors to herding behavior. Therefore, the sectorial evaluation in the PSX could be enhanced by the intense exploration of the herding phenomenon.

4.2   Implications

The rationale behind the higher herding effects (signal to noise ratio) in the sugar sector may be attributed to seasonal effects[3]. Another prominent herding is noted in the financial sector. The herding of the financial sector may be influenced by the monetary policy shocks, which create more signal-to-noise ratios as compared to other sectors. The herding in the oil and gas sector is third-highest due to its signal-to-noise ratios among all the industries. The oil and gas sectors are mostly affected by the international crude oil price changes. Comparatively, a lower herding effect is found in the textile and manufacturing sector (real sector), which shows that these two sectors are stable in terms of herding behavior as compared to other sectors. As the sugar industry is seasonal, a monetary policy statement is issued every two months, and oil and gas sectors are dependent on international crude price, whereas, textile and manufacturing sectors are relatively stagnant than the sugar sector. Hence, based on the above results we can conclude that Pakistani investors are more sensitive towards frequent news about any stocks and show herding behavior. Perhaps, investors in Pakistan may prone to react more in less stagnant industries.

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[2] In Pakistan, raw material of sugar industry (sugar cane) is not available throughout the year. It is based on seasonal production of sugarcane.

4.3   *Future Research*

Future studies can be conducted encompassing various factors in emerging as well as developed countries which can consort interesting findings on investors' rational or irrational behaviour. Apart from encompassing various factors of emerging and developed countries, the impact of economic stress on people affecting their investing decision may be explored where COVID-19 pandemic or terrorism-based periods can be used as economic distress proxy. Additionally, cross-market herding behaviour can be an alluring topic of discussion for expanding this area of behavioural finance literature.

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