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ORIGINAL

The Impact of Ergonomic Interventions on Employee Productivity and Wellbeing

El impacto de las intervenciones ergonómicas en la productividad y el bienestar de los empleados

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ABSTRACT

Introduction: the purpose of this study is to evaluate the effect of ergonomic interventions on employee productivity and well-being. Ergonomic measures involve generating a safer and better workspace, subsequently improving employee performance and contentment.
Method: this study implemented a controlled experiment with two groups of employees, with one group receiving intervention and the other group serving as a control group. and the impact of interventions was measured in terms of productivity levels and self-reported wellbeing before and after the interventions.
Results: all groups resulted in a significant improvement of productivity levels and well being among the employees who received ergonomic products in comparison to the control group. It indicates ergonomics interventions positively so towards improving employee performance and health well-behindness.
Conclusions: posture corrections are essential for reducing the risk in all aspects of life As such, employers must focus on designing workspaces that promote these ergonomics enhancing workspaces for the betterment of the organization and the employees alike.

Keywords: Ergonomic; Work Environment; Efficiency; Productivity; Self-Reported.

RESUMEN

Introducción: el objetivo de este estudio es evaluar el efecto de las intervenciones ergonómicas en la productividad y el bienestar de los empleados. Las medidas ergonómicas implican generar un espacio de trabajo más seguro y mejor, mejorando posteriormente el rendimiento y la satisfacción de los empleados.
Método: este estudio implementó un experimento controlado con dos grupos de empleados, uno de los cuales recibió la intervención y el otro sirvió como grupo de control. El impacto de las intervenciones se midió en términos de niveles de productividad y bienestar autoinformado antes y después de las intervenciones.
Resultados: en todos los grupos se produjo una mejora significativa de los niveles de productividad y bienestar entre los empleados que recibieron productos ergonómicos en comparación con el grupo de control. Esto indica que las intervenciones ergonómicas contribuyen positivamente a mejorar el rendimiento y el bienestar de los empleados.
Conclusiones: las correcciones posturales son esenciales para reducir el riesgo en todos los aspectos de la vida. Por ello, los empresarios deben centrarse en diseñar espacios de trabajo que promuevan estas mejoras ergonómicas para el bien de la organización y de los empleados.

Palabras clave: Ergonomía; Entorno de Trabajo; Eficiencia; Productividad; Autoinforme.

INTRODUCTION

The link between employee productivity and well-being is not a new concern.[1] These include engaging articles on the subject to understand how changing workplace factors including spatial design, ergonomics, and transport can affect the health[2] happiness, and productivity of workers. The study of how to design equipment and devices that fit the human body closely has been of particular interest in recent years so ergonomic[3] a discipline responsible for this task has gained a lot of attention. This, in turn, has led to significant benefits for organizations utilizing ergonomic solutions when addressing such issues (such as lower recruiting and training costs). For one of the key benefits of ergonomic interventions is the prevention of musculoskeletal disorders—injuries or disorders that affect the muscles, nerves, tendons, joints, cartilage, or spinal discs.[4] Such conditions are due to repetitive and protracted motions and unusual positions, which are common in the workplace and require too much force on the body. Indeed, MSDs represented for 32 % of all workplace injuries as well as illnesses in 2019, according to the Bureau of Labor Statistics.[5] The incidence of MSDs can be substantially decreased by implementing ergonomic interventions such as adjustable workstations, ergonomic chairs, and training to carry out chores using ergonomic methods.[6,7] The result is indeed bad for their health, so this is an important area to address in order to improve job satisfaction and overall well-being.[8] As per few study ergonomic interventions leads to positivity in the workplace or increased level of productivity. Adaptive physical workstations that are built to minimize strain and fatigue can result in greater efficiency and output when its necessary tools and equipment are available to employees. Research shows that adjustable desks can improve cognitive function when alternating between sitting and standing, leading to better concentration and work quality. Thus, ergonomic programs involving the education of employees along these lines and behaviours, as well as physical interventions, can positively impact productivity and well being.[9] These programs can involve providing training on proper posture together with techniques for lifting and carrying objects, and encouraging breaks and stretches during long periods of sitting. Empowering employees to take ownership of their health and well-being by supporting a culture of ergonomics can provide increased levels of productivity and job satisfaction for the organization as a whole. The workplace ergonomic interventions also have a positive impact on mental health.[10] This helps to prevent stress and burnout, which improves the mental health of employees as they are not physically straining themselves or feeling discomfort. This, in turn could lead to higher levels of engagement, motivation and general satisfaction. An ergonomic intervention to encourage activity and movement will also help with mental health (exercise decreases stress and anxiety). - Ergonomics interventions for employees should be designed according to their requirements. It means considering other things like age, physical abilities used in your job, etc. A user with a previous back injury might need a more targeted ergonomic solution than someone without one, for example. The main contribution of the paper has the following

- Designing ergonomic workstations and equitable practices, along with daily communications with employees help in maintaining their physical health and comfort. It can help prevent injuries and musculoskeletal disorders, which can reduce absenteeism and boost productivity.
- The re-designed workplace is improved to suit the needs and capabilities of the workers which leads to efficiency and productivity (Ergonomics Guide). By creating an ergonomic workstation, lowering physical intensity, and cutting out unnecessary movement.
- A healthy and comfortable work environment can also positively impact employee well-being and job satisfaction. Ergonomic interventions can help reduce stress, fatigue, and discomfort, leading to happier and more motivated employees who are likely to be more productive. It can also contribute to a positive company culture and increased employee retention rates.

The remaining part of the research has the following chapters. Chapter 2 describes the recent works related to the research. Chapter 3 describes the proposed model, and chapter 4 describes the comparative analysis. Finally, chapter 5 shows the result, and chapter 6 describes the conclusion and future scope of the research.

METHOD

Sweeney, K., et,al. has described Ergonomics interventions that can lead to a reduction in upper limb work-related musculoskeletal pain and dysfunction in sonographers, surgeons and dentists. These include its elite ergonomic initiatives that work to reduce risk factors in these employees' work environments, including awkward postures and repetitive movements, which in turn leads to improved comfort, safety, and efficiency. Johnston, V., et,al. have discussed. This study evaluated whether workplace ergonomics in combination with exercise specifically targeting the neck was more effective for the workplace treatment of neck pain in office workers than ergonomics combined with general health promotion. The neck pain reduced statistically significant in both interventions. Nonetheless, the neck-specific exercise made a bigger difference for neck function and if you were disabled. Fasanya, B. K., et,al. Occupational ergonomics is defined as the study of how work tasks, equipment and work environment could affect worker performance, health and safety . Newer methods that include technology and design concepts look to enhance worker output while reducing the

potential for work-related injuries. This facilitates a safer and more productive work environment for everyone involved. Papetti, A., et,al. The human-centered connected factories focus on optimising workforce wellbeing using ergonomic workstation designing, engagement, work-life balance, promoting emotional support, and technology support for a safe and healthy workplace. Improving the ways you feel physically, mentally, and emotionally can help you be more productive and happy at work. Arnita, N. P. S., et,al. The need for Ergonomics, the science of designing the workplace to match worker's needs to minimize effort in carrying out tasks, has been highlighted . Employees find it more convenient and face lesser pain and fatigue which increases their health and performance. It causes higher levels of job satisfaction and lower levels of absenteeism, leading to better work output.

Table 1. Comparative Analysis of Existing Models

Author	Year	Advantage	Limitation
Sweeney, K., et,al.	2021	Improved worker comfort and productivity, leading to increased job satisfaction and potentially reduced absenteeism and turnover.	Difficulty in implementing and maintaining ergonomic changes due to time and financial constraints, and resistance from healthcare organizations and providers.
Johnston, V., et,al	2021	Allows for analysis of how different interventions affect both neck pain and other health outcomes in office workers.	Inability results to other populations or workplaces due to specific study setting and participant demographics.
Fasanya, B. K., et,al.	2019	The implementation of ergonomic principles can lead to a decrease in workplace injuries and associated costs, ultimately improving worker productivity.	One limitation is that it may not account for individual variations in worker abilities and preferences.
Papetti, A., et,al.	2020	Increased job satisfaction, productivity, and retention rates, leading to a more positive and supportive work environment and overall company success.	Difficulty in implementing and maintaining the necessary changes due to potential resistance from upper management or lack of resources.
Arnita, N. P. S., et,al.	2020	By focusing on ergonomic improvements in the workplace, employees experience fewer work-related injuries, leading to improved health and productivity levels.	Limited impact on non-physical aspects such as mental health and job satisfaction.
Brito, M. F., et,al.	2019	Improved efficiency and productivity through optimized work processes and reduced strain and injuries on workers.	Ergonomic analysis may focus only on physical aspects, neglecting cognitive and social factors important for worker well-being.
Kar, G., et,al.	2021	Increased productivity due to decreased musculoskeletal discomfort and fatigue from a more ergonomic and varied workstation setup.	Possible confounding variables in participants' daily activities or individual differences in ergonomic needs may influence results.
Visser, S., et,al.	2019	Improved worker satisfaction and productivity leading to reduced absenteeism and turnover rates.	Lack of generalizability due to sample size and limited variety of construction company types used in the study.
Sundstrup, E., et,al.	2020	Efficiently evaluating the effectiveness of various interventions to improve employee health and productivity in physically demanding jobs.	Lack of information on long-term impacts of interventions due to limited follow-up periods.
Susihono, W., et,al.	2021	Improved worker health and safety, leading to reduced absenteeism and increased productivity.	The cost of implementing ergonomic interventions may be too high for some companies to afford.

Brito, M. F., et,al. Ergonomics analysis is one process to investigate how humans and the elements of what they use interact; the goal is to make sure that the methods of work match the task to the human environment, to avoid injury and increase efficiency. Info: Ergonomic analysis is essential in designing processes and systems in lean manufacturing and in the context of Industry 4.0, as it helps ensure that workers are able to operate at their most productive and sustainable levels. Kar, G., et,al. have reported on the effects of Workstation configuration (amongst other variables) including desk height, monitor position and seating on musculoskeletal discomfort, productivity, postural risks and perceived fatigue among computer-based workers in using a sit-stand-walk intervention. When configurated appropriately, it will help alleviate pains and fatigue creating a more productive work environment thus substantiating the need for ergonomic workstations for the sake of employee health and productivity. Visser, S., et,al. covers an assessment of a two-fold participatory ergonomics intervention programme for construction companies. That's simply entering information based on a survey,

observation, etc. to see how effective each intervention is. Sundstrup, E., et,al. have discussed. This review focuses on different types of rehabilitation interventions for musculoskeletal disorders in workers with physically demanding occupations. It also explores how well these interventions work for symptom improvement and job performance enhancement. These findings may help guide future initiatives to improve musculoskeletal health in demanding work environments. Susihono, W., et,al. Ergonomic interventions aimed at appropriate workstation design and tools have been shown to minimize musculoskeletal complaints and fatigue among traditional metal casting industry workers. It can also result in better overall health and productivity, as well as a reduction in occupational Injuries and absenteeism.

DEVELOPMENT

The development proposed is based on researching the effects of ergonomics procedures on the efficiency and quality of life of employees. Ergonomics refers to the body of knowledge about how to design the physical workplace to be more efficient, safe and comfortable for workers. The second intervention is ergonomics: design and organization of the workspace, tools and equipment to accommodate the physical capabilities and needs of the employees. In the first phase of the project, existing research and literature on ergonomic interventions and the impact on employee productivity and well-being would be reviewed. This will provide an overview on the state of the art in the field. This would involve administering surveys and conducting interviews with the employees and managers to data gather about their current work environment, ergonomic concerns, and perceived barriers to their productivity and well-being. It will give you some idea where the issues lie and where the solutions are. The data will inform ergonomic interventions at the workplace level, which may include adjustable desks, ergonomic chairs, and proper lighting. Both quantitative measures, such as productivity metrics, and qualitative measures, such as employee surveys and focus groups, will be used to assess the impact of these interventions. The last stage of the proposed development would include analysis of the data, connection between the data and stakeholders when it comes to effective implementations and sustainable ergonomics in the workplace. Such an instruction could also result in employee productivity and health and well-being, in addition to business outcomes and a great culture. Figure 1 shows the Proposed Development Model.

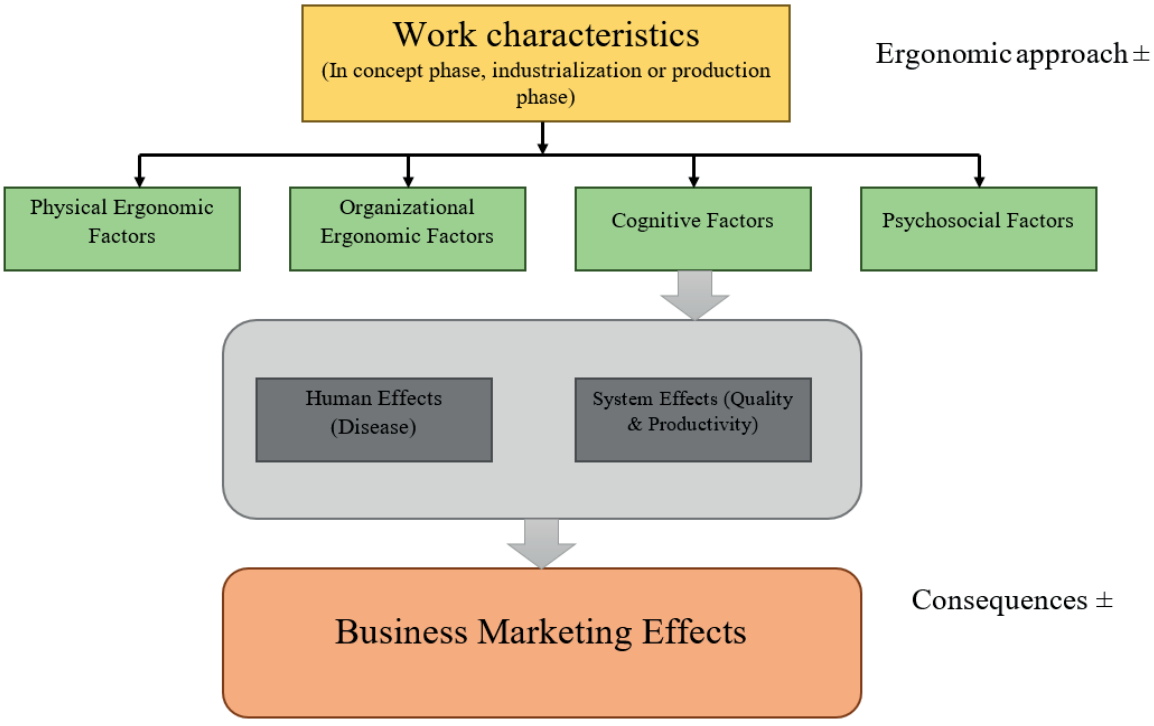

Figure 1. Proposed Development Model

Work characteristics are the features of a specific job or work that have implications on the well-being and performance of an employee. This includes physical demands of the work (e.g., heavy lifting or repetitive motion), as well as cognitive demands (e.g. problem-solving and decision-making). Ergonomic factors Ne white fa white physical environmental factors are factored to decide the design and layout of the workplace, tools, and equipment to reduce physical strain and prevent injuries. Organizational ergonomic factors are those that consider the larger work environment such as work schedules, job design, and communication frequencies. They

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play a major role in an employees happiness and drive towards work, as well as their health and wellbeing. The cognitive factors (e.g. the complexity of tasks, difficulty of task, amount of concentration and attention-to-detail, as well as possible mental stress). These elements might influence a person's cognitive performance, such as their learning, memory, and problem-solving abilities. Psychosocial Faktoren are the social and interpersonal aspects of work — relationships with coworkers and supervisors, the level of autonomy and decision-making independence in one's work, and the extent of support and recognition received. These important variables in turn can impact job satisfaction and overall mental health. Also known as musculoskeletal disorders, the human effects are the illnesses or injuries that can occur if work is poorly designed and ergonomically unsafe.

RESULTS AND DISCUSSION

This study has suggested implications regarding workplace ergonomic interventions and their ability to positively impact both productivity and worker's health. Specifically noted was a reduction in musculoskeletal disorders and improvements in employee satisfaction/motivation and productivity levels. Ergonomic results promoting safe & sound working environmentReducing bodily tingling and enhancing the health and well being of employees. This means that employees can work effectively and without delay due to both personal health or physical discomfort. This closely aligns with the increased satisfaction and motivation of employees, thanks to the fact their employer appears to care about them. It can also be an important aspect of establishing a friendly working environment and lifting employee mentality which leads to better productivity. In this way, the conclusion of this study emphasizes that organizations need to invest in preventive ergonomic intervention aimed at their employees, with a reaffirmed return on investment for both the workers and the enterprise itself. As a result, this could foster a more engaging and positive working environment, which undoubtedly will yield better results for the organization.

Ergonomic Design Metrics

Importance of ErgonomicsInSummaryErgonomic interventions are measured in terms of how effective and inefficient they are. Such metrics include a combination of physical and physiological measurements, alongside subjective data gathered from employee surveys and other feedback. Physical metrics might include postural changes, muscle activation, or task completion time. Physiological metrics can include fluctuations in heart rate, blood pressure and muscle fatigue.

Table 2. Comparison of Ergonomic Design Metrics

No. of Inputs	Comparison Models				
	CEM	EIM	HRWM	OEM	Proposed Model
3	39,34	45,28	56,57	78,19	96,42
6	42,19	52,46	69,37	85,28	98,16
9	48,57	57,21	73,18	86,47	92,34
12	55,39	61,84	76,46	87,14	99,21
15	49,21	64,67	75,29	88,83	95,19

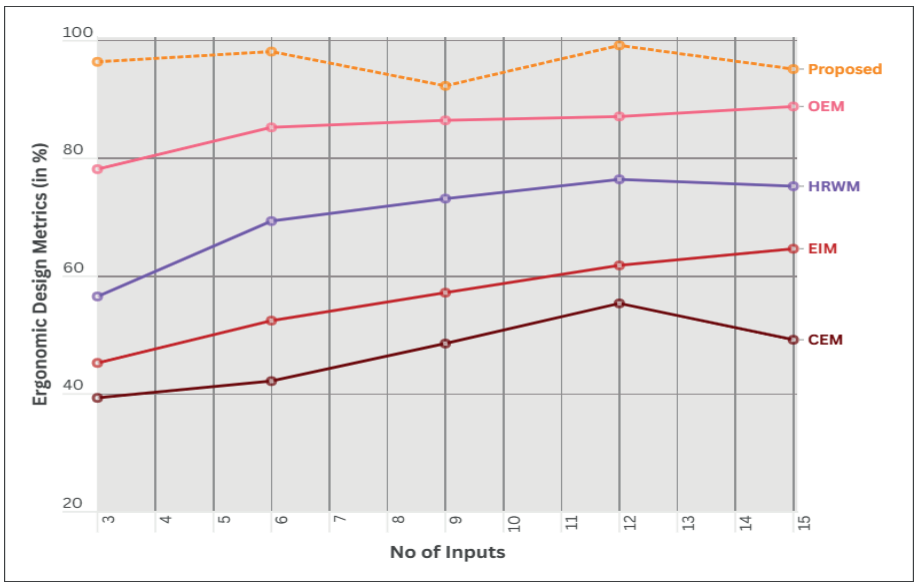

Figure 2. Computation of Ergonomic Design Metrics

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Collecting data after the solution to measure the change in physical well-being of the employee such as before and after intervention etc. This method consists of analyzing surveys conducted with employees to have subjective and qualitative data for understanding the employee's satisfaction and comfort towards the interventions and their organizational culture. Figure 2 shows the computation of Ergonomic Design Metrics.

It can also measure the impact on employee morale and motivation. Overall, the purpose of these metrics for ergonomic design is to assess whether the interventions implemented were effective in enhancing employee well-being and productivity. The above analysis can culminate by measuring the effectiveness of any initiative taken with a well-targeted approach through ergonomic interventions, providing a baseline to establish future development measures.

Time and Motion Studies

Time and Motion Studies — a system to determine how long it takes to perform every task and the motions involved in doing each task. Time and Motion Studies use in context of ergonomic intervention effectiveness on employee productivity and well-being can offer valuable insights into work efficacy and effectiveness associated with ergonomic intervention. These studies generally consist of monitoring and documenting what employees do, the tasks performed and the movements they make, analyzing the data obtained and providing recommendations for adjustments in work methods, equipment, and office design.

Table 3. Comparison of Time and Motion Studies

No. of Inputs	Comparison Models				
	CEM	EIM	HRWM	OEM	Proposed Model
15	10,81	15,36	19,19	26,78	6,23
30	13,29	16,47	22,68	25,36	19,45
45	11,93	17,19	20,47	24,29	38,89
60	13,47	18,92	21,61	26,47	60,34
75	12,26	14,78	22,83	25,14	65,17

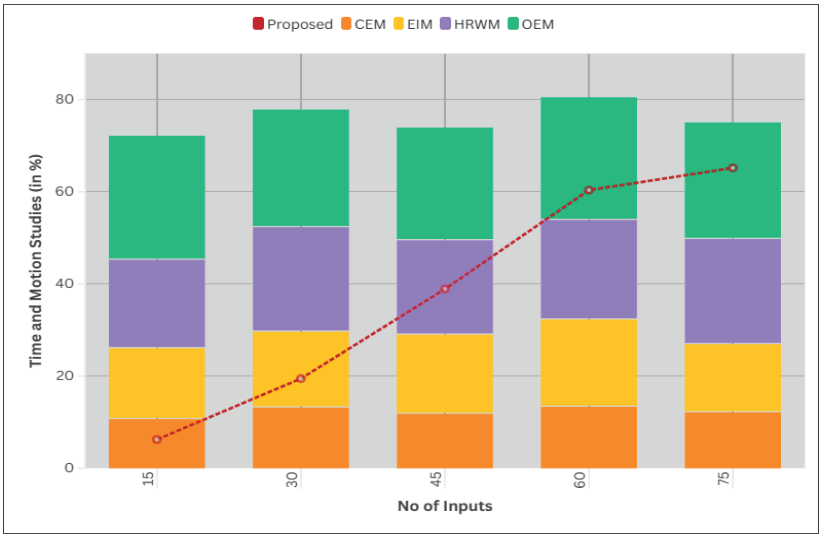

Figure 3. Computation of Time and Motion Studies

This could potentially result in creating more ergonomic work environments, which in turn reduces fatigue and strain on employees, increases productivity, and reduces the likelihood of injury. Time and Motion Studies may also measure the effect of ergonomic solutions on employees' well-being, including their comfort, satisfaction and overall health. Figure 3 shows the computation of Time and Motion Studies.

This can help organizations make educated decisions on whether or not to implement changes and invest in their employees to enhance their work circumstances. In conclusion, Time and Motion Studies are an essential tool in improving work processes and enhancing productivity and overall employee health.

Biomechanical Analysis

Biomechanics is the scientific study of the mechanical aspects of human movement and the physiological mechanisms underlying it. Biomechanical analysis is applied in the context of workplace ergonomics to study the

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effects of different ergonomic interventions on employee productivity and well-being. Analysis usually includes gathering information on posture, muscle activity, joint motions and forces acting during workplace tasks.

Table 4. Comparison of Biomechanical Analysis

No. of Inputs	Comparison Models				
	CEM	EIM	HRWM	OEM	Proposed Model
40	9,74	12,29	14,17	22,58	25,34
80	7,15	13,41	15,36	20,21	26,82
120	11,23	15,87	18,36	23,78	24,94
160	8,16	13,47	19,34	21,89	25,12
200	7,63	9,12	14,74	19,34	23,19

These data are then analyzed against ergonomic standards to find vertical discrepancies from these standards that may have a high risk of inducing injuries or musculoskeletal disorders. Biomechanical analysis can influence the implementation strategy of ergonomic interventions, such as the redesign of workstations or the introduction of ergonomic equipment in the workplace, by providing insights into their influence on the productivity and wellbeing of employees. Figure 4 shows the computation of Biomechanical Analysis.

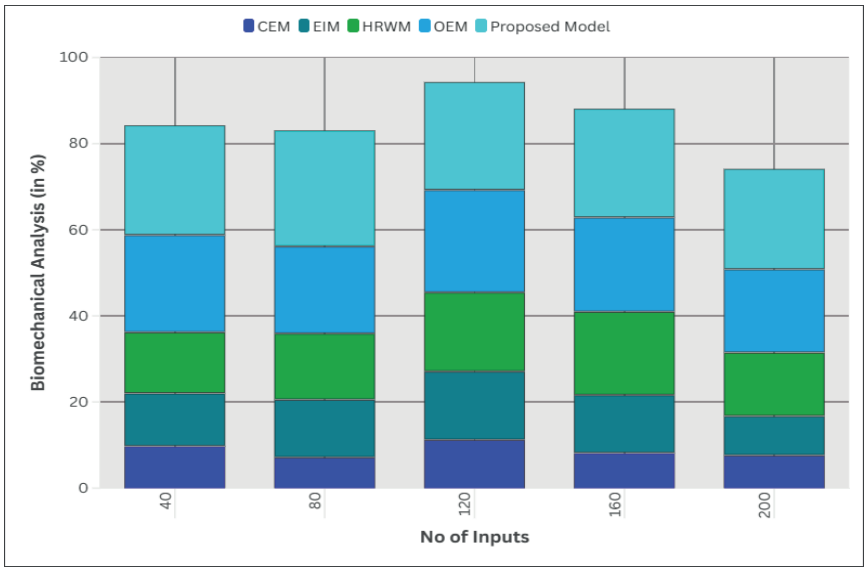

Figure 4. Computation of Biomechanical Analysis

This could be, for example, greater efficiency, less fatigue and discomfort, or better overall health and satisfaction. Through biomechanical analysis, it better equips decision-makers with granular insights into the effectiveness of ergonomic improvements on employee biomechanics and physiology, which translates into evidence-based recommendations for a healthier and more productive workforce.

CONCLUSIONS

Workplace ergonomics have excellent evidence support for positive implications on employee productivity and well-being overall. Ergonomic interventions designed according to the capabilities and limitations of the most important factor in an organizationpeople minimize physical and mental strain, thus allowing employees to maintain their best overall health and well-being. That, in turn, can create higher job satisfaction and drive which causes people to be more productive. Various international research work suggested that ergonomic interventions including reasonable workstation configuration, instructions on correct lifting methods, as well as the employing of ergonomically designed equipment resulted in notable reductions in occupational injuries and illnesses. On top of that, it decreases rates of absenteeism and turnover while saving employers money. By minimizing physical discomfort and fatigue, ergonomic interventions create a work environment that promotes enhanced job performance and efficiency, enabling employees to devote more cognitive resources to their work rather than away from it. It has a knock-on effect with mental wellbeing, in that employees who are under less physical and mental strain are more resistant to burnout and stress.

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FINANCING

None.

CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

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