

Achieving Sustainable Development through Total Quality Management in Nigerian Construction Industry.

Alintah-Abel U.V¹; Okolie K.C²&Agu N. N³

¹Department of Quantity Surveying, Faculty of Environmental sciences, Enugu State University of Science & Technology (ESUT), Enugu.

²Department of Building, Faculty of Environmental Sciences, NnamdiAzikiwe University, Awka.

³Department of Quantity Surveying, Faculty of Environmental Sciences, NnamdiAzikiwe University, Awka.
Corresponding Author: Alintah-Abel U.V

Abstract: Achieving sustainability-related targets in construction industry is increasingly becoming a key performance driver. The paper work attempts to establish ways of achieving sustainable development through total quality management in Nigerian construction industry. The study further sought to find the correlation between the total quality management principles and the dimensions of sustainable development in order to find out how important they are to sustainable development. In achieving the objectives, a survey instrument using structured questionnaires and interview were developed and used to collect data to test the sustainable development using total quality management. The data was analyzed using Statistical Package for Social Science (SPSS) version 22. In addition to descriptive statistics such as tables, percentages, simple means and standard deviation, inferential statistical tools were employed; Pearson's Product Moment Correlation Coefficient was also employed. The results of the study suggest that there is a significant correlation between total quality management and Sustainable development. The principles of TQM if well applied bring about improvement and increase in the values of the organizational culture and effectiveness in satisfying conducive environment and enhance profitability. Furthermore, it was discovered that top management and leadership and continuous improvement are best principles for implementing total quality management; however, the research showed that the rest of the principles are also vital for the achievement of sustainability. Finally, this paper proposes a framework for achieving sustainable development using total quality management principles. This will ensure that client's satisfaction is reached and bring about improvement and increase in the values of the organizational culture and effectiveness in satisfying conducive environment and enhance profitability.

Keywords: Sustainable Development (SD), Construction Industry, Total Quality Management (TQM), Continuous Improvement, Customer's Satisfaction

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I. Introduction

Globalization, industry growth and technological change interact to create alternative environments with varying levels of dynamism and complexity requiring realignment of operation strategies. Along with quality, cost, delivery, and flexibility, customer focus is another competitive priority to adapt fitting operation strategies proactively in changing environments¹. The strategies must be deployed effectively which can help for a successful initiatives. The client being knowledgeable in this has increased the use of competent companies to actualize their goals. This is evident from clients' increase use of companies' reputations for good quality work as a basis for selecting prospective contractors. It is vital that the construction industry, developing economies implement effective quality management practices to address the perennial concerns of the industry regarding poor performance, poor quality of works, and lack of innovation and professionalism, given the threat of global competition and the demand for building and civil engineering products,.

The major problem faced by most construction company in Nigeria is on how to adopt a strategy for high quality building that will satisfy the needs of the owner at a reduced and effective price and still ensure that they remain in business without any involvement in debt². Solving such a problem can be frustrating Most times, because various goals often seem to be inconsistent with one another such as low quality building resulting in the owner's dissatisfaction. These problems are multifaceted due to the fact that the owner wants to spend the least amount possible for the highest quality end product. The challenge now arises on how the company will meet the demand of the clients by providing high quality building at the lowest cost particularly in a time of extensive competition from various bidders. However, despite all effort made in the different fields in adapting new strategies and implementation procedures, sustainable development in industries has become a major concern in the last decade both in developed and developing countries. The adoption of the TQM

approach in the Nigerian market should enhance the project and task quality, increase productivity and profitability, employee and client satisfaction, and augment company reputation by being able to compete globally with high quality standards.

Total Quality Management is a quality management system which pursues excellence in customer satisfaction through continuous improvement of products and processes by the total involvement and dedication of everyone involved in the process or the product^{3,4}. When applied effectively, TQM enables a company to improve long-term relationships, create a harmonious team spirit, enhance professionalism and skills in all spheres of the construction sector, encourage open addressing of problems and help to achieve the intended project objectives and benefits⁵. The vision for sustainability of a project should be planted as early as possible as decisions made at this stage have significant impact on the overall project. Sustainability should be integrated into all activities within the project process with close interaction among all construction workers.

Research work has been carried out on total quality management in construction industry but none has focused on the correlation of total quality management principles from one stage to another and from time to time in a particular stage of a project lifecycle to achieve sustainability. This has made the realization of the sustainability goals difficult. This paper aims to investigate the role of implementing total quality management procedures throughout the project building processes as an approach for delivering sustainable construction projects in Nigeria. To achieve this aim, following are the objectives: to explore the various total quality management principles available; to study sustainable development; to establish a correlation between Total quality management and sustainable development throughout the project life cycle and to develop a framework of total quality management for sustainable development.

II. Literature Review

Over view of the concept of total quality management

Total quality management is a management philosophy that seeks to integrate all organizational functions to focus on meeting customer needs and organizational objectives⁶. A definition by the US Department of Defence that succinctly captures the essence of the concept is: "TQM utilizes both quantitative (technical) methods and human resource (behavioural) practices to improve material and service inputs, intra- and inter organisational processes, and to sharpen the focus on meeting customers' needs⁷.

Total Quality is the highest level of quality management that refers to a management process and set of disciplines that are coordinated to ensure that the organization consistently meets and exceeds customer requirements through continuous improvement. TQM is an effective system for integrating the quality development, quality maintenance and quality improvement efforts of various aspects of a system so as to enable services at most economical level and derive full satisfaction⁸. It is a preventive, proactive approach to doing business and as such it reflects strategic leadership, common sense, data-driven approaches to problem solving and decision making, employee involvement, and sound management practice⁹.

TQM is aimed at the satisfaction of customers' needs in an efficient, reliable and profitable way. This means that it delivers the highest value for the customer at the lowest cost while achieving sustained profit and economic stability for the company. It engages all divisions, departments and levels of the organization. Top management organizes all of its strategy and operations around customer needs and develops a culture with high levels employee participation. TQM companies are focused on the systematic management of data in all processes and practices to eliminate waste and pursue continuous improvement¹⁰. Top management must commit to a vision, often expressed in a mission statement, and align and train its employees toward that common goal. The problems of costs, productivity, occupational safety and health in the construction industry can be tackled by implementing TQM. This implies that the implementation of TQM will achieve a better construction work. Most firms believed that TQM is a good idea, however the methods and effectiveness of implementing TQM, vary substantially between companies over the years¹¹. Some firms completely abandoned their TQM implementations while others achieved award-winning results.

Principles of TQM

1. **Top management commitment and leadership:** The upper management is the driving force behind implementing TQM. TQM must start at the top with chief executive. The commitment of the leadership to TQM strategy as shown in their daily disposition to work will go a long way in motivating employees to deliver quality services that exceeds the expectations of customers⁶. When there is a long term relationship with satisfied customers, it will be an asset to the organisation, thus, management must be committed to it.
2. **Cultural change:** The total quality culture implies the decentralization of responsibility to the lowest cadre. This makes quality central to every employee and management in the organisation. TQM emphasises the need for change from the traditional approach of quality management which is bureaucratic in nature and which gives little or no room for innovation. By so doing, it taps into the intellectual capability of every individual in the organisation in the process of continuous quality improvement. The need for cultural

change is stressed by the role it plays in the life of an organisation. Culture influences what the executive groups attend to, how it interprets information and the response it makes to changes in the external environments¹². It is exceedingly crucial in the drawing up of the strategic position of the firm as it dictates how members of staff approach their day to day activities. Culture is said to help an organisation in planning and implementing their strategy.

3. **Total involvement:** Empowerment and involvement of employees in decision making is viewed as essential for sustained result. Thus the main aim for the total involvement of employee is to boost internal and external customer's satisfaction by developing a flexible environment which allows for innovation¹³. The experience and abilities of all the employees are utilized and they are given autonomy or a level of freedom to perform function such as information processing, problem solving and decision making.
4. **Continuous improvement:** Continuous improvement means a commitment to constant examination of the technical and administrative process in search of better methods¹⁴. It refers to improving value for customer by constant refinement and improvement of products, services and organisational system from the levels of planning and decision making to the execution of work by the front line staff. The principle behind the idea of continuous improvement is basically the idea that mistakes can be avoided and defects can be prevented. This can be achieved by the continuous identifying and eliminating those activities that add little or no value to products or services rendered thereby improve quality of product or services in the absence of customers' complain.
5. **Training:** Training helps in preparing employees towards managing the TQM ideology in the process of production. Training equips people with the necessary skills and techniques of quality improvement which will help in achieving the business aims and objectives. Through training, employees are able to identify improvement opportunities as it is directed at providing necessary skills and knowledge for all employees to be able to contribute to ongoing quality improvement process of production¹³. However, training and development programme should be a continuous process not a onetime event.
6. **Team work:** Team work is a key feature of involvement which leads to commitment of the workforce to the organisational goals and objectives. A well-structured team will be able to tackle a complex problem through the pulling of resources together, contributes to the generation of improvements that are proposed by employees, make recommendations which are more likely to be accepted and implemented and boost workers morale and ownership through participation in problem solving and decision making.

Other elements of TQM include: employee involvement, quality assurance; quality information system and application, continuous improvement, flexibility, benchmarking and strategy planning, process management, product and service design and quality control, employee management and empowerment and corporate quality culture¹⁴.

Benefits of TQM

1. **Training needs** - When a TQM rollout is due, all the employees of the company need to go through a proper cycle of training. Once the TQM implementation starts, the employees should go through regular trainings and certification process.
2. **Customer orientation** - The quality improvements should ultimately target improving the customer satisfaction. For this, the company can conduct surveys and feedback forums for gathering customer satisfaction and feedback information.
3. **Involvement of employees** - Pro-activeness of employees is the main contribution from the staff. The TQM environment should make sure that the employees who are proactive are rewarded appropriately.
4. **Techniques and tools** - Use of techniques and tools suitable for the company is one of the main factors of TQM.
5. **Corporate culture** - The corporate culture should be such that it facilitates the employees with the tools and techniques where the employees can work towards achieving higher quality.
6. **Continues improvements** - TQM implementation is not a onetime exercise. As long as the company practices TQM, the TQM process should be improved continuously.

Other benefits for implementing TQM include: higher customer satisfaction, reduction in construction costs, improved employee job satisfaction, improved schedule performance, improved relationships with subcontractors, reduced rework, improved safety, higher productivity, lower employee turnover, speeding up construction work, improved methods of working, better control over the construction process, gaining competitive advantage, increase profitability, decreasing waste and rework, better coordination of activities and more customer focused^{16,17,18}.

Sustainable development

Sustainability development has been an issue of interest for all stakeholders in the construction industry. It is a pattern of economic growth in which the use of resources aims to meet human needs while preserving the environment, so that those needs can be met not only in the present, but also for generations to come. The term ‘sustainable development’ was used by Brundtland Commission which coined what has become the most often-quoted definition of sustainable development: “Development that meets the needs of the present without decreasing the ability of future generations to meet their own needs”. The concept of sustainable development is often categorized into three constituents¹⁹. They are Social sustainability, Economic sustainability and Environmental sustainability. This is normally regarded as a triple bottom line of sustainability.

The construction industry addresses the three dimensions of sustainability; environmental, social and economic, in different ways²⁰. Environmental factors in construction encompass the use of natural resources, waste minimisation, and energy and water efficiency to prevent a harmful effect on the environment. Social aspects include taking the stakeholders into account which include employees, suppliers and the community, and economic factors include the construction industry’s contribution to economic growth and employment.

III. Methodology

This study employed survey approach in which both primary and secondary data were used for this research for effective and efficient utilization of the method been adopted. Primary data were gathered through questionnaire and interviews issued to 3 construction firms within Enugu metropolis who had TQM as their quality improvement program; to sample their opinions on the implementation of Total Quality Management (TQM) for Sustainable Development of the Nigeria environment. The study employed systematic random sampling to select those construction firms. The sampling size was as a result of time constraints.

The questionnaire was divided into three sections; A, B and C. The first part sought the demographic background of respondents. The second part consisted of questionnaire items as indicators of the seven principles of TQM adapted from the review of literature. The indicators were to be rated using a five-point Likert scale in which 1 represents strongly disagree, 2 disagree, 3 uncertain, 4 agree and 5 strongly agree. The third part assessed the perception on how the implementation of TQM leads to sustainability. Sustainability was measured using the 3 baseline indicators rated by respondents using a five-point Likert scale similar to the one in the second part of the questionnaire. The questionnaires were personally delivered to the selected construction companies who were in turn requested to deliver them to the most experienced or qualified site manager for completion. Secondary data were also used in form of published works; Internet, Libraries, Books and Journals. Completed questionnaires from the field was edited and coded appropriately. Editing was done to correct errors, check for non-responses, accuracy and corrects answers. Coding was done to facilitate comprehensive quantitative analysis of the data. The data was analyzed using Statistical Package for Social Science (SPSS) version 22. In addition to descriptive statistics such as tables, percentages, simple means and standard deviation, inferential statistical tools were employed; Pearson’s Product Moment Correlation Coefficient (PMCC) was employed. A total of 30 questionnaires were administered out of which 24 were completed and returned. The response rate was 80 percent.

Decision rule

The mean base line is determined as follows; having five (5) likert questionnaire options which are

SA= strongly agree	-	5
A= Agree	-	4
D= strongly disagree	-	3
SD= disagree	-	2
DN= Don’t Know	-	1

The mean of the response option becomes

$$\frac{5 + 4 + 3 + 2 + 1}{5} = 3.0$$

Therefore the decision was made that any mean score up to and above the stated average of 3.0 was interpreted as accepted that is positive while any mean score below 3.0 was considered as reject that is negative.

IV. Results

Demographic Characteristics of the Respondents

Table no 1: shows the respondent's years of practice

Size	Medium (2 no)	Large (1 no)
Year	5-10 yrs 10-20 yrs	Above 30 yrs

Table no 2: shows the respondent's designations

Managers	Accountants	Procurement Officers	Operations	Field Engineers
5	2	3	7	7

Table no 3: shows the respondent's profession

Business Administration	Building	Project management	Architecture	Quantity Surveying	Engineering
2	3	3	5	3	8

Questionnaires

Total Quality Management Practices of the Respondents' Companies

The questions generated show how the respondents' perceived TQM practices within their construction organizations. Table 5 shows that the mean of the elements of TQM all above the criterion mean base line 3.0. This suggests that respondents' companies in general, had fully implemented TQM. The grand mean rating is 3.36 which is also above the criterion mean. The standard deviations (SD) lie between (0.59 - 0.85), this indicates homogeneous data and less spread out or dispersed.

The results indicate that Top management commitment has the highest mean (3.81) while Reward and Recognition had the lowest mean of 3.03. The results indicated that the means of all the variables in the study were above the scale mid-point (3.0) which suggest that respondents' firms attach importance to all the TQM aspects assessed. However, high level of priority (importance) is accorded to top management (Mean = 3.81, SD = 0.59) and Continuous improvement (Mean = 3.64, SD= 0.61) as these ranked first and second respectively. These were followed by total involvement (mean = 3.49, SD = 0.68), cultural change (mean = 3.20, SD = 0.73), team work (mean = 3.18, SD = 0.80) and Training (mean = 3.14, SD = 0.82) in that order. Reward and recognition (Mean = 3.03, SD = 0.85) was accorded relatively low level of priority. This is shown in table no 4 below:

Table no 4. Prioritization of Total Quality Management practices of respondents

TQM Principles	Mean (M)	Stddvt (SD)	Decision	Rank	Category
Top Management Commitment and leadership	3.81	0.59	ACCEPT	1	High
Continuous Improvement	3.64	0.61	ACCEPT	2	High
Total involvement	3.49	0.68	ACCEPT	3	Medium
Cultural Change	3.20	0.73	ACCEPT	4	Medium
Team Work	3.18	0.80	ACCEPT	5	Medium
Training	3.14	0.82	ACCEPT	6	Medium
Reward and Recognition	3.03	0.85	ACCEPT	7	Low
Grand total	3.36	0.73			

Correlation Test for Association between TQM Principles and Sustainability development

The results of correlation test between the TQM variables and Sustainable development is presented in Table no 5. The results indicated that Total Quality Management variables are strongly, positively correlated with Sustainable Development(SD).There was a significant, positive relationship between Reward & Recognition and sustainable development ($r = 0.671, p < 0.05$). Similarly, a significant, positive correlation is shown to exist between team work and sustainable development ($r = 0.688, p < 0.05$). There is also a significant, positive relationship between top management commitment& leadership and sustainable development ($r = 0.701, p < 0.05$).

A significant, positive correlation also exist between continuous improvement and sustainable development ($r = 0.692, p < 0.05$).The results show that the relationship between total involvement and Sustainable development is significant and positive ($r = 0.773, p < 0.05$) Correlation analysis of cultural change and sustainable development indicated a significant positive relationship ($r = 0.823, p < 0.05$) A significant positive relationship also exists between training and sustainable development ($r = 0.754, p < 0.05$).A strong criterion-related validity exists between the variables since the bivariate correlations of the TQM practices with sustainable development were statistically significant.

Table no 5: Shows results of correlation test between the TQM variables and Sustainable development

	RR	TW	CC	CI	TI	TCL	TG
Correlation coefficient (SD)	0.671**	0.688**	0.701**	0.692**	0.773**	0.823**	0.754**
Sig(1-tailed)	0.0034	0.0231	0.0445	0.0321	0.0356	0.02143	0.0332

**Correlation is significant at the 0.05 level (1 – tailed). : Sustainable Development; RR: Reward & Recognition; TW: Team work; CC: Cultural Change; CI: Continuous improvement; TI: Total involvement; TCL: Top management commitment & Leadership; and TG: Training.

Oral interview

The interview questions addressed the following main areas: Background of interviewees; Interviewee’s perception of total quality management; Factors affecting their productivity; Quality report and measurement; Process of implementing TQM; Relationship between output and workforce; Cultural /environmental influence on project; Quality report and measurement.

Additional questions were asked for further clarifications particularly on occasions where responses given were not sufficient or clear enough. This allowed a more in depth discussion about the subject matter. Ten (10) selected interviewees for each organisation were interviewed. Altogether, 20 people were interviewed face to face from the two case study companies. Each interview lasted between 1-2 hours and were recorded using a digital recorder.

V. Discussion of findings

From the interview done relationship was done between the 7 key principles of total quality management and the 3 bottom line of sustainability; which are environmental, social and economical.

- **Leadership:** This focuses on the management of the company. The leadership can be on a small a level eg gang leader. Management can be vertical. The Social implication deals with the image of the company that they want to protect and when this happens the company will also increase their income. With respect to the environmental sustainability, if there is good leadership, they will guide the workers on the quality of end products. These products will not have adverse effect on the environment and can be used by future generation. This will help to the successful completion of the project and the satisfaction of the client. It was found that top managers exercise leadership by consultation, seeking the consent of subordinates and shareholders before making decisions. Finding revealed that leadership was ranked first with a mean of 4.67, showing how important it to sustainability
- **Continuous Improvement:** The focus of all the companies are to find ways to constantly improve their products and services so that they will be able to meet the Client’s requirements which are to deliver the work on time, within the budget and to meet set quality. Companies that meet those requirements are always sort after which will bust their images (Social Sustainability), increase the number of contracts they get (Economical Sustainability) and they will produce high quality work that will not have adverse effect on the environment (Environmental Sustainability). Findings revealed that continuous improvement was ranked second with a mean of 4.61, indicating that it is very important.
- **Total involvement:** The workers are empowered to be part of decision making. This normally helps to feel appreciated and the experienced ones among them can give vital information that can help to upgrade the environment. It will also improve how the staff relate with each other (Social Sustainability) and at the end; it will improve the economy (economic sustainability). Finding revealed that total involvement was ranked third with a mean of 4.59, indicating how important it is to sustainability.
- **Cultural change:** This involves strategies. Location of a project can change the concept of the workers which will affect the direct supervision of the management. For instance a site that is located at the insurgence prone areas will have strategies mapped out to suite the area, it can lead to social sustainability. Methodology that is used at each site might vary based on peculiarity of the site. Findings revealed that cultural change was ranked fourth with mean of 4.59 which is the same with total involvement showing how they were closely rated.
- **Team Work:** There is a saying that no one is an island. The workers need each other’s input to be able to increase their output (economic Sustainability). Team work helps to boost the morale of the staff. Social sustainability is easily achieved when they can relate with each other. From the findings, it revealed that team work was ranked fifth with mean of 4.58. This is just a difference of 0.01 from total involvement and cultural change, indicating that it is as vital as others.
- **Training:** Improving ones skills and technique is vital in other to satisfy the client. The companies frequently train their staff so as to achieve better results. There are some mitigative measures that are used

in construction works so that they will not have negative effect on the environment (Environmental Sustainability). Also various ways of increasing output and on time (economic Sustainability) and different ways to relate with workers, client and stakeholders (social sustainability). These are some of the issues that workers undergo training to acquire. From the findings, it revealed that training was ranked sixth with mean of 4.57, however it still a vital principle.

- **Reward and Recognition:** Workers are given awards for certain achievements. Workers that meets set targets can be rewarded which can be in monetary form. It can also be inform of day off. This kind of actions boosts their morale, change their perception for work making them to thrive to be better at all times. Findings revealed that reward and recognition was ranked seventh with mean of 4.53. Though it was ranked last, the difference between it and training which is the sixth is just 0.04, indicating that it is also vital.

Development of a framework of total quality management for sustainable development

Based on the literature review, questionnaire and interview conducted, a framework of total quality management for sustainable development is developed below:

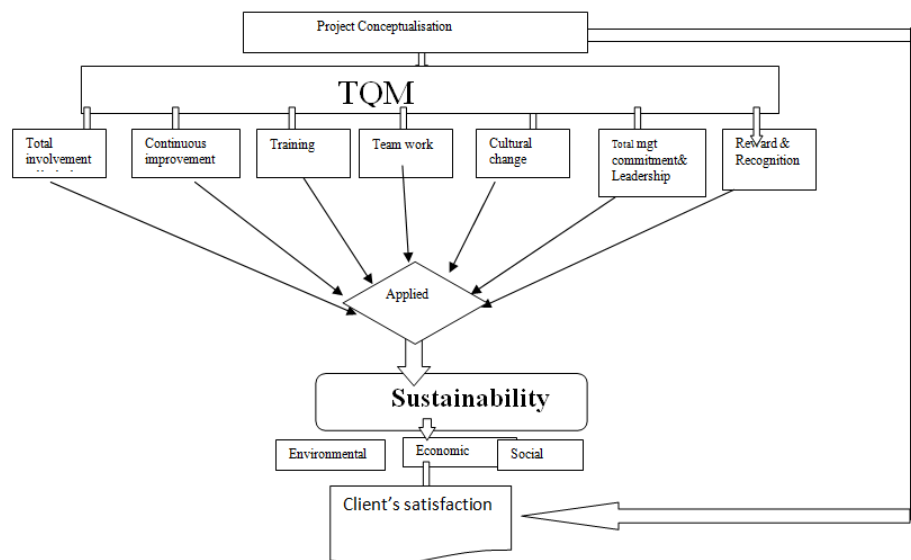


Figure 1: Framework of total quality management for sustainable development.

VI. Conclusion and Recommendation

The findings of this research have confirmed the benefits that accrue from implementation of TQM. It showed a significant relationship between TQM and SD. The principles of TQM if well applied bring about improvement and increase in the values of the organisational culture and effectiveness in satisfying conducive environment and enhance profitability. In the course of this research, the researchers found out the top management & leadership and continuous improvement are best principles for implementing TQM. However, the research showed that the rest of the principles are also vital for the achievement of sustainability. From the framework created, it showed that when a project is conceived by the client, all the principles of TQM must be applied which will result to sustainability. This sustainability will encompass the three elements which include environmental, social and economical. When this happens, it will result to client's satisfaction which shows that what was conceived initially was met.

TQM should be directed toward customer satisfaction and employees' involvement within the company. The executive level managers must give top priority to quality and not just pay lip service to it. Workers at all levels must ready to be involved in the implementation process. The main reason of total quality management is to meet customers/ clients' optimum requirement. This must be given utmost priority at all times. Top managers should not exercise decision making in themselves over their subordinates but manage by objectives to give the organisation edge over their competitors and make the subordinates have relevance and sense of belonging. The highest level of performance requires a well-defined and well-executed approach to continuous improvement and learning. This must be maintained at all times because continuous improvement is the key arm of total quality management. Organizations can improve on their system via effective TQM in order to achieve a high level of sustainability development. Effective TQM should be utilized to the best advantage, while seeking to continually improve on them. The development manager (TQM leader) should provide training, seminars, workshops, and presentations to other departments on the importance of the implementation

of the TQM principles in the company. Spreading the awareness of TQM is essential, especially in the earlier stages because every person in the company must learn the concept before it can be applied.

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