

ISSN 2454-9169

# SURYA-THE ENERGY MANAGEMENT RESEARCH JOURNAL

(Quarterly Double Blind Peer Reviewed Referred Journal)

VOLUME - 3 | Issue - 4 | October - December 2017



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**Management Research Journal**  
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for January - March 2018 issue**

The next issue of the Journal SURYA-THE ENERGY January - March 2018 invites papers that explore the key approaches from Human Resource, Marketing and Finance Management.

The length of the Research paper / Case Study / article should be between 3000 and 3500 words. It is absolutely necessary to provide the required references in the body of the text, so that the readers are informed about the sources of the data, information, views or opinions. Further, the author is solely responsible for the accuracy of all the figures, quotations and references. Please follow APA style of referencing.

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## *From the Desk of Chairman, Editorial Board...*



*Like previous issues, this issue of Synergy - A Quarterly Management Journal for the quarter October - December 2017 also contains an array of interesting articles A Study of Portfolio Risk Management, Evaluating Unified Threat Management Products for Enterprise Networks, Consumers Buying Behaviour towards Two-Wheeler Motor Bikes, Co-relational study on Organizational Commitment and Organizational Citizenship Behavior with reference to Indian Faculties, Modeling of Microchannel Integrated Cantilever for Ultra-Sensitive Detection of Biomacromolecules, Electronic Waste: A Growing concern in Today's Environment, An Overview on Agricultural Marketing in India, Impact on employee's productivity with regular training and development activity, A Study on "Data Science : Why & How?" & A Study of Working Capital Management : Literature Review. to name a few*

*The Editorial Board takes the opportunity to thank all the contributors for whole heartedly extending their support through research papers and consequently in bringing out this October - December 2017 Issue.*

*The content and standing in all the published articles are exclusive views and personal opinions of the respective authors and they do not necessarily reflect the official views and opinions of the Editorial Board of the Institute. We hope this Issue would definitely bring innovative value addition in your existing knowledge.*

*Happy Reading!!*

**Prof. (Dr.) Sanjay B. Chordiya**  
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**Abstract**

The future is uncertain event no one can predict exact future but we can reduce the risk in uncertain event. In case of investment we cannot forecast return exactly but we can use portfolio risk management technique to reduce the risk of portfolio. There are various risk management techniques of portfolio. In this paper researcher explore the meaning of portfolio, types of portfolio and benefits of portfolio. Also study about various portfolio risk management technique. This paper based on secondary data. The portfolio risk management techniques are very useful to reduce the risk of investment.

**Introduction**

The investment is ongoing activity, is engaged the people who have saving. The investment means employment of fund with goal to achieve high returns with low risk. The objectives of paper are to study about portfolio, types of portfolio, benefits of portfolio and portfolio risk management techniques. The study is based on secondary data.

The investor cannot make entire saving in a single security. Instate, they tend to invest in group of securities. This group of security calls as portfolio. The portfolio helps to investor to reduce the risk without sacrificing returns. As per the economical, financial & political conditions risk of portfolio changes. The investors always expect good return with low risk. But risk is inversely proportional to returns; this is universal phenomenon of investment. The simple meaning of risk is variability in return. The return is stable it means low risk investment & return is fluctuate it mean high risk investment. Basically there are two types of risk systematic & unsystematic. The systematic risks are influence by economical, political & social changes. The systematic risk classified into interest rate risk, market risk & purchasing power risk. The unsystematic risk is

influence only company issuing such security. The unsystematic risk classified into business risk & financial risk.

There are two types of portfolio active portfolio & passive portfolio. An active portfolio holds the security based on forecast about future returns. The active portfolio is dynamic i.e. investment is change as per market conditions with buy & sell approach. The passive portfolio holds well diversified for long term with buy & hold approach. The portfolio also classified as per risk taking strategy, aggressive portfolio, moderate portfolio & conservative portfolio. We are discussing each & everyone in details. An aggressive portfolio is appropriate for an investor with a high risk tolerance and a time horizon longer than 10 years. Aggressive investors are willing to accept periods of tremendous market instability in exchange for the possibility of receiving high relative returns that outpace inflation by a wide margin. The asset allocation of aggressive Portfolio are 85% Stocks, 15% Bonds. A moderate portfolio is suitable for an investor with a fairly high risk tolerance and a time horizon longer than 5 years. Moderate investors are willing to accept periods of moderate market volatility in exchange for the possibility of receiving returns that outpace inflation by a significant margin. The asset allocations of moderate portfolio are 65% Stocks, 30% Bonds, and 5% Cash / Money Market. A conservative portfolio is appropriate for an investor with a low risk tolerance and a time horizon

from immediate to longer than 3 years. Conservative investors are not willing to believe periods of tremendous market instability and are looking for returns that match or slightly outpace inflation. The asset allocations of Conservative Portfolio are 25% Stocks, 45% Bonds, and 30% Cash/Money Market.

The profit of portfolio is, it facilitates good corporate and project governance as it uses performance and corporate resources against input objectives. The portfolio management maximizes the return & minimizes the risk of investment. The portfolio gives opportunity to investor optimal allocation of resources. It offers all the benefits of a mutual fund plus the flexibility of buying stocks in a phased manner or in a conducive market.

### **Review of Literature**

The portfolio is a combination of a variety of securities. Portfolio can be constructed with the help of traditional approach and modern Approach. The main objective of portfolio management is to help the investor in investing in various securities so, that risk is to be minimized and to get higher yield of return. In traditional approach the constraints, investors need for current income and constant income are analyzed. The basic objectives of portfolio are current income, constant income, preservation of capital, capital appreciation.

The investment strategy of active portfolio management provides lower



return to investing in the MSCI Denmark. However, maintaining a fixed level of systematic risk upon portfolio repositioning, portfolio return inferior to the standard is justified as the standard demands higher systematic risk in order to generate higher return. In addition, given portfolio systematic risk exceeds benchmark systematic risk portfolio return is in such case positively significant. In that regard active portfolio management adds value to the investor.

In this paper author compared two different approaches to measure risks associated with hedge fund portfolios. Comparing the two methods, we highlighted the need to capture all the major portfolio risk components to develop a meaningful portfolio risk management practice. Omitting any of the risk components would provide an incomplete picture that may severely underestimate or overestimate the true risk associated with the portfolio.

### **Objectives of the Study**

The objectives of paper are to study about portfolio, types of portfolio, benefits of portfolio and portfolio risk management techniques.

### **Research Methodology**

The study is descriptive. It is based on secondary data which is collected from Books, journals, reports and websites.

### **Portfolio Risk Management**

The risk management in portfolio is one of the important tasks. There are various techniques to manage the risk in portfolio. For calculating the risk in portfolio security, the riskiness of each security within context of overall portfolio has to be considered. This depend on interactive risk, it means how the returns of security move with the returns of other securities in portfolio & contribute to overall risk in portfolio. The process of combination securities in a portfolio is known as diversification. The goal of diversification is to reduce total risk without sacrificing portfolio return. There are three cases to reduce the risk in portfolio. First when security returns are perfectly positive correlated, second when security returns are perfectly negatively correlated and third when security returns are uncorrelated.

First when security returns are completely positive correlated. When security returns are perfectly positively correlated the correlation of coefficient between two securities will be +1.

$$\bar{p} = x_1\bar{o}_1 + x_2\bar{o}_2$$

$\bar{o}$  = Standard Deviation

$x$  = Proportion of investment

$$\text{e.g. } (0.5)(60) + (0.5)(40) = 50$$

The security returns are completely positively correlated; diversification provides only risk averaging and risk reduction because the portfolio risk cannot be reduced below the

individual security risk. The diversification is not a productive activity when security returns are perfectly positively correlated.

When security returns are perfectly negatively correlated. When security returns are perfectly negatively correlated the correlation coefficient between two securities will be -1.

$$\tilde{\sigma}_p = x_1\tilde{\sigma}_1 - x_2\tilde{\sigma}_2$$

$\tilde{\sigma}$  = Standard Deviation

x = Proportion of investment

e.g.  $(0.5)(60) - (0.5)(40) = 10$

The portfolio risk is very low. The portfolio may become entirely risk free when security returns are perfectly negatively correlated. The diversification becomes highly productive activity when securities are perfectly negatively correlated, because portfolio risk can be considerably reduced & sometimes even eliminated.

When the returns of two securities are entirely uncorrelated, the correlation coefficient would be zero.

$$\tilde{\sigma}_p = \sqrt{x_1^2\tilde{\sigma}_1^2 + x_2^2\tilde{\sigma}_2^2}$$

$\tilde{\sigma}$  = Standard Deviation

x = Proportion of investment

$$\tilde{\sigma}_p = \sqrt{(0.4)^2(50)^2 + (0.6)^2(30)^2} = 26.91$$

The portfolio standard deviation is less than the standard deviations of individual security in portfolio. Thus, when security returns are uncorrelated, diversification reduces risk & is productive activity.

### *Diversification Rules*

Investment diversification reduces the overall risk of a portfolio. I recommend you set up definitive rules and abide by them. I don't put more than 5% of my portfolio in any one stock, or 15% in any one fund or ETF, or 25% in any one industry. Diversification lowers portfolio volatility without reducing expected returns.

### *Maximum Portfolio Drawdown*

How much of your investment portfolio you are willing to lose; or maximum portfolio drawdown, is a measurement of a portfolio decline from a peak to its lowest point. This is critical risk management concept that very few investors give consideration to. Develop a policy and you will sleep better at night, and improve your investing skills.

### **Conclusion**

The risk management in portfolio is important task. If investor fails to manage risk of portfolio, he faced losses. The process of combination securities in a portfolio is known as diversification. There are two types of portfolio active portfolio & passive portfolio. In portfolio there are two types of risk arise, first is systematic & second is unsystematic risk. . The goal of diversification is to reduce total risk without sacrificing portfolio return. At the time of diversification investor consider about standard deviation of portfolio. The securities are perfectly negatively correlated it

means risk of portfolio is low. To reduce the risk of portfolio is difficult task but is not impossible to reduce the risk of portfolio. Using above technique investor can reduce the risk of portfolio.

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## ***Evaluating Unified Threat Management Products for Enterprise Networks***

**Rahul Dwivedi  
Nitin S. Shirao**

### **Abstract**

The term Unified Threat Management (UTM) has as many meanings as there are products that carry the label. While UTM has primarily focused on the small- and medium-sized business (SMB) network, products are coming to market aimed at the enterprise. This white paper will help you understand the specific issues enterprises need to consider when assessing UTM products, and offer guidance on evaluation criteria for enterprise-class UTM. At its core, UTM brings together three main ideas: multiple security features, integrated on the basis of a mature firewall, deployed in an appliance form-factor. The intuitive appeal of UTM is obvious: why have two (or three or four) boxes performed separate functions, when a single box will do? As security threats to corporate networks have increased at an alarming rate, the number of devices combating these threats has grown at nearly the same speed. However, at some predictable point, it's not feasible to have every new threat addressed by its own dedicated device.

### **Keywords**

Dynamic Routing, Security, Performance, Flexibility,.

### **Introduction**

The reasoning behind UTM has resonated strongly with managers commanding SMB networks, as UTM firewalls — called such because the firewall is the undisputed lynchpin of the UTM product — have quickly become a standard offering from every vendor. In this market space, UTM firewalls, with combined features including anti-virus protection and intrusion prevention built into the same appliance, reduce costs and simplify configuration.

UTM products in larger enterprise networks are not an easy sell primarily because most UTM products are indeed aimed directly at the SMB environment and

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Assistant Professor

*Prof. Nitin S. Shirao*  
Assistant Professor

enterprise network and security managers haven't had reason to view them as appropriate parts of their security strategy. Fortunately for the higher end, this product deficit is quickly changing as enterprise-class firewall vendors are adding UTM features to their product lines.

Obviously, evaluation and design criteria for UTM in enterprise networks must be very different from those of SMB networks. When UTM concepts are brought to bear on large networks, in ways appropriate to those networks, they offer the network and/or security architects tremendous flexibility to control and mitigate the risks associated with security vulnerabilities.

Because UTM, in general, and especially UTM in enterprise networks is new, network managers need a framework to evaluate products and match them to enterprise requirements. We will now explore six unique issues for network and security architects to consider that should be addressed for any enterprise-sized deployment of UTM.

### **Performance Requirements**

The pivotal selection criterion for any security product is performance. As enterprise networks have become absolutely business critical. Poor performance, low throughput, high latency, or dropped packets caused by improperly sized security products, are completely unacceptable.

UTM architectures are especially vulnerable to the question of performance because measuring and reporting traditional metrics such as goodput (often called "throughput") is a developing art rather than an agreed-upon science. In conventional performance measurement exercises conducted on traditional security devices such as firewalls, the metrics of connection rate, connection capacity, and goodput are easy to measure and report. For example, in measuring firewall performance, it's generally sufficient to hook well-known measurement tools such as Spirent® Communications' Avalanche™ or Reflector™ appliances on either side of a device, spin the dials to generate simulated traffic, and interpret the metrics for your own network. Vendors are happy to provide this information — and you can trust the results — because there are only a few scenarios to test and the tools are readily available.

With UTM, system performance is dependent on which features are enabled and how those features are configured. For example, turning on anti-virus scanning in a UTM device will slow down performance. Scanning both e-mail and HTTP traffic for viruses will slow down performance more than simply scanning Web traffic.

To further complicate the situation, performance will vary depending on what the actual data moving through the system comprise. If your e-mail includes numerous attachments, the UTM device will have to work hard. If

most of those attachments are in compressed archives, such as ZIP files, the UTM device will have to work even harder. If many of your e-mail messages are in Japanese (or any language with double-byte Unicode representation), the virus scanner will have to work harder than if they were in English (or any language with single-byte characters).

Enterprise network managers considering UTM devices should key in on products that have the ability to scale performance without requiring forklift upgrades. A product design that accommodates scalability with the ability to drop in additional processor cards or accelerators, or to change out a processor card on the fly, is certainly an outstanding starting point.

However, the best products go further and optimize these modular hardware upgrades by using features such as internal load balancing. This is valuable because every UTM feature (such as anti-virus or intrusion prevention) has a different set of performance characteristics and simply turning on a feature will not cause a linear increase in load. For example, suppose enabling anti-virus features triples your CPU load — not an unreasonable assumption. But if your only option is to add a single anti-virus accelerator or dedicated CPU module, that limited expansion capability puts a ceiling on performance. However, if you have the option of adding two CPU modules, with load balancing

between them, then the anti-virus load would minimally affect total system performance.

### **Testing with Tools**

Test tools can be used to provide performance measures, as long as you are aware that actual performance may vary from the actual flows on a real network. When testing UTM devices, it helps to be as real as possible. Based on our past history of testing UTM devices, keep in mind these three points when setting up the traffic mix to be pushed by these synthetic traffic generators:

Every device will undergo a fairly constant (although often low-level) set of attacks from the Internet, and these need to be a part of any test. We have found that alerting systems and forensics databases may not scale with acceptable performance as they get filled up with data over a period of days or weeks.

Traffic performance is based on the actual data, meaning you need to send as close to a 'real' data stream through the device as possible. You will need to send real threats, such as viruses (and not just the EICAR test virus, which is often artificially optimized for super-high performance in anti-virus products), in approximately the same proportion as your own data stream. For example, most enterprises have about a 1% rate of viruses in email once spam is taken out.

Testing should be run to determine

the performance effect of each independent variable, as well as the system as a whole. For example, if you are looking to add anti-virus and intrusion prevention, run three tests: anti-virus alone, intrusion prevention alone, and both combined.

When evaluating performance, enterprise network managers will hit yet another complication because there is no agreed-upon testing methodology for UTM devices. The traditional metrics, such as connection rate, goodput, latency, and connection limits, are all valid, but vendors tend to play up their bigger numbers first, not really supplying enough detail to make an apples-to-apples comparison, and not offering enough scenarios to handle the variety of security configurations a UTM device might be expected to support. Without common methodologies and tools to test devices, the only real way to test UTM devices is to put them into real networks and run them with real data passing through them. (See “Testing with Tools” for some hints on how to test performance of UTM devices.)

### **Integration Requirements**

Enterprise-class UTM devices need to support the complicated network topologies present in larger corporations. Four key points of integration that require support include interface flexibility, dynamic routing, high availability, and scalability.

Based on their SMB roots, UTM

devices have traditionally sat at the perimeter of the network, replacing an edge firewall. However, in enterprise networks, firewalls are scattered throughout the network to harden and protect it from both external and internal threats. Enterprise-class UTM devices need to offer flexibility to work both at the edge and deep within the network. When a UTM device is properly designed, it becomes equally useful no matter where it is placed. For example, while an edge device may need only two or three interfaces (“inside” and “outside”), an internal firewall will need a much higher interface count (one for each server group) as well as VLAN capabilities, to support as many security zones as necessary.

Network managers of larger networks use dynamic routing protocols to simplify overall configurations and provide more robust service in the face of topology changes and service outages. Enterprise-class UTM devices must integrate with existing routing fabric and support common enterprise routing protocols, such as OSPF. When considering a UTM device for an enterprise network, support of the network's native routing protocols, interface types (such as fiber or copper gigabit interfaces with VLAN capabilities), and scalability requirements (such as integration with an internal or external load balancer) is critical.

In addition to routing and interface flexibility, any critical network resource, such as a firewall acting as

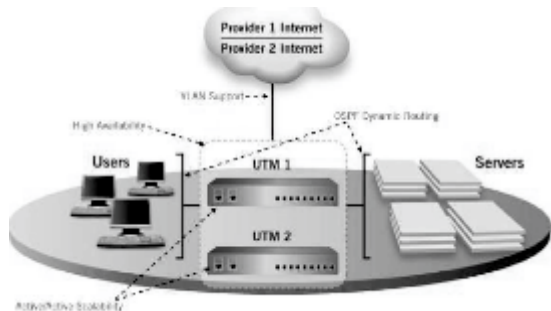
a choke point between network zones — a likely point of deployment for a UTM device — must be engineered for both availability in the face of component failure and scalability in the inevitable event of increasing loads.

High availability can mean many things, but the simplistic, core requirement here is that the failure of any part of a UTM device — whether hardware or software — should not interrupt the flow of traffic through the network. At the same time, availability brings the second element of scalability into the UTM picture. As large production networks become more and more critical to overall business operations, UTM devices must have the ability to scale in performance without interruption of service.

Measuring, testing, and evaluating scalability and high availability means understanding how the UTM device will interact with your network and then validating that it won't take the network down either because of component failure or system overload. Validation can be a difficult and expensive process, but it is critical in this environment. If you don't have in-house expertise to conduct testing, this is a definite place to consult outside help.

In many ways, these four requirements simply differentiate between basic SMB firewalls and traditional enterprise-class firewalls. However, “integration” for a UTM device will extend beyond these

examples to include the necessity to mesh with existing desktop management systems, depending on the UTM services involved, or existing anti-virus systems or even existing intrusion prevention systems (IPS) and intrusion detection systems (IDS). Evaluating this aspect of UTM firewalls could be as simple as checking for support with your other security service vendor, but it's dangerous to assume that a check box on a web page represents true integration.



Enterprise-class UTM must smoothly integrate into the existing network, which means that features such as dynamic routing and VLAN support are required. Well-designed scalability and high availability strategies are also needed to support the needs of enterprise networks.

An older term in many enterprises is “consolidation”, more specifically “firewall consolidation.” The concept entails looking at the firewalls scattered around the network and considering whether one box might do where three, four or five sit now. Consolidation, or at least re-considering architectures to see if



consolidation is appropriate, is a healthy activity.

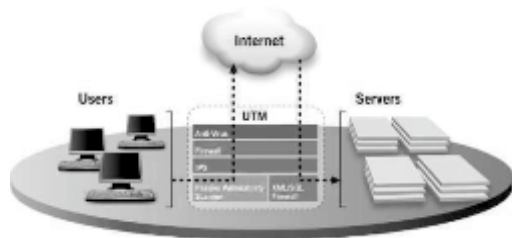
Consolidation of other, non-firewall functions can also benefit the security manager. If network functions such as routing and load balancing can be consolidated into a single device, this reduces the tight interlock between network and security devices. A complex and less reliable topology can often be consolidated down to a smaller number of more functional systems. The result of device consolidation is greater freedom for security teams to make changes and updates without having to interact with the network team.

It's important to understand that consolidation alone is not the sole purpose of UTM, but that UTM deployments benefit from consolidation. There are clear benefits to any enterprise in consolidating security functionality into a smaller number of devices and management points such as cost savings, higher levels of reliability, and lower levels of complexity, to name a few. But simply sticking a bunch of firewalls into one large über-firewall doesn't provide the same benefits as UTM.

The goals of consolidation — higher reliability and simpler management— overlap with the goals of UTM. A firewall consolidation project may or may not have a UTM component and should be considered separately, using its own justification and evaluation criteria.

Adding UTM into a consolidated firewall brings even stronger benefits because it means that threat mitigation services can protect more than an Internet-facing barrier. Consolidated firewalls, by their nature, protect multiple security zones. The common argument that networks are becoming “de-perimeterized” is especially true in this environment, in which a single perimeter is replaced by a set of perimeters — all protected by the same device. By having the ability to watch most, if not all, of the traffic traveling between different security zones, the consolidated firewall becomes an obvious point to bring UTM services into play in a very cost-effective way.

When firewalls have been consolidated in large networks that consolidated firewall becomes an ideal place to add in UTM functionality. Therefore, a firewall consolidation discussion should always include the question “Will we be introducing UTM features here?” By pursuing a firewall consolidation project without first considering UTM, you risk revisiting the project sooner than you'd expect or to want



*UTM supports consolidation by integrating multiple security*

*functions into a single device. A critical requirement of a consolidated device is the capability to direct traffic flows through the UTM device, activating different functions, because not every security function applies to all flows.*

Consolidated and other internal firewalls add another twist to the UTM evaluation. A “traditional” UTM firewall generally includes anti-virus and IPS features as a minimum — features specifically designed to help in perimeter protection between corporate networks and the Internet. However, when the consolidated/internal firewall is used as the UTM base, internal threat management security functions are just as appropriate for addition to the UTM firewall. For example, Layer 7 application-specific firewalls, such as XML and database firewalls, all the way down to network visibility and vulnerability detection functions, facilitated by tools like passive network scanners, are all threat management functions that belong inside the network and fit well in a consolidated firewall offering UTM services.

When evaluating UTM for an enterprise network, it's wise to not only focus on threats you want to counter at the edge, but also on threat management that is most appropriate deep in the network. Enterprise-class UTM architectures can support these types of services.

### **Enterprise-class UTM features: Not a simple checklist**

Because UTM has received a lot of attention from the press and analyst community — as well as firewall buyers — firewall vendors have worked to add UTM features onto their existing systems, either to keep

up with the crowd or because the title “UTM” does indeed sell more boxes. Of course, UTM in the context of firewalls is not a particularly new idea. The actual thought of performing multiple threat mitigation processes on a single system is quite old. For example, the makers of proxy firewalls, the oldest firewall technology deployed in networks today, all argue their “deep inspection” provides additional threat mitigation.

However, IDC's Charles Kolodgy nailed a description onto the banner of UTM by saying that any UTM device must comprise firewall, IDS/IPS and anti-virus services. This edict had the unfortunate side effect of turning UTM into a simple checklist question: “do I have IDS/IPS and anti-virus? If so, the ensuing press release can read: It's a UTM!”

The critical issue is that UTM has to meet your network's requirements. It's very clear that a successful UTM deployment for your network might not include either IDS/IPS or anti-virus — but that doesn't mean it's not UTM.

The rush to create UTM products has created an additional problem: the match (or mismatch) between threat mitigation features and your requirements. IPS technology sets up a great example of this potential mismatch. Enterprise IPS can be a complex endeavor, with questions of management, forensics, signature tuning, as well as the base technology itself, which can range from rate-

based to signature-based to anomaly based detection and every combination in between. Most UTM products, especially those in the SMB space, simply take an open source tool, add a poorly designed GUI, and slap the IPS label on it. The result is not even a strong IPS service for an SMB environment, and it certainly isn't going to support enterprise requirements.

IPS isn't the only example of a touchy UTM feature. Anti-virus coverage, one of the most popular UTM features (because of IDC's definition), varies wildly from product to product. Some vendors support anti-virus scanning of only Web traffic. Others scan email. Some are configurable in terms of what they will scan, including protocol and port numbers; others are not.

The key evaluation issue becomes whether or not the UTM feature set meets your needs, not whether there is a check mark in the anti-virus box on the vendor's glossy list. The better UTM architectures are designed to meet the needs of enterprise networks, and can prove it by offering both the features you need and a full disclosure about what exactly each feature does.

Many UTM vendors try to derail this argument by pulling out a favorite codeword: "best of breed." "Best of breed" is supposed to explain how the particular product, selected by the UTM vendor, is the right one for you — because it's the "best!" The reality is that "best of breed" means different

things to every network. If the UTM vendor writes some component of its product, such as the virus scanner or the IPS, themselves — as is common in SMB-oriented devices — the term "best of breed" disappears from marketing literature to be replaced by another: "cost effective."

The result of this almost random decision about what products will go into a UTM firewall is that the quality of the pieces, whether "best of breed" or "cost effective," has received a well-deserved bad reputation. Firewall vendors have a relaxed attitude about the quality of the pieces they add to their UTM firewalls, driven more by marketing and partnership pressures than what is best for the customer. This attitude has created a bad taste in the enterprise security architect's mouth, where features are not there simply to fulfill a checklist.

In UTM products suitable for an enterprise deployment, you should expect that most vendors will integrate third-party products for almost all of their UTM capabilities, rather than try to build the technologies that will serve to be all things to all people. Good UTM architectures not only have well-respected security vendors represented, but also afford choice among the vendors included in the stack. This is particularly important for anti-virus services, where an enterprise needs to pick products that properly complement its server-side and desktop security strategies.

Just as important as breadth in vendor choice is depth in UTM

features. Enterprise-class products can't stop at the anti-virus and IPS check boxes because enterprises need more. Good products allow the customer the flexibility to select UTM features based on their network's requirements, not on what the UTM vendor decided to put in place. Of course, no one expects full flexibility to run any application, but a good UTM product is one that gives the enterprise manager a broad choice of features making it easy for third-party security vendors to integrate technology into their platform.

What security tools can be expected in an enterprise class UTM device? While it may seem like the firewall/VPN base is a given, that's not necessarily so — although it's unlikely that anyone will try and introduce a device under the UTM banner that is not built on top of a solid firewall/VPN base. IPS, Web content filtering, and anti-virus / spyware / phishing / spam are likely to be the most popular and thus most readily available security features. IDS may be available, but is unlikely to be as good a UTM fit as IPS features are. Layer 7 applications and protocol specific firewalls will be a strong differentiator between SMB and enterprise-class UTM devices, with XML, Web, and SQL firewall features likely candidates. Finally, security focused more on the end user and less on content, such as patch management, vulnerability assessment, and other NAC-oriented features will round out enterprise UTM.

## **Platform Extensibility and Flexibility**

The UTM marketplace is filled with fixed configuration devices, because they meet the needs of SMB networks at an affordable price point. Extensibility, as needed for larger deployments, drives up costs. That said, it is a clear requirement, not just for interface density, but also for interface flexibility.

An extensible platform can grow with hardware needs: more CPU, more memory, more interfaces and I/O. But additionally, an extensible platform should also grow “out of the box.” Enterprise networks often need multiple devices, not just for high availability and scalability, but because they have multiple locations, complex network architectures, and rarely have just one of anything. Element management, where each device is managed separately, is not acceptable in this environment. Having multiple devices requires that management tools cleanly cross firewalls.

Performance needs (covered in greater detail above, see section on “Performance”) also call for extensible platforms. Turning on UTM features always translates to a performance hit, meaning the ability to extend platform performance at the same time you extend the functionality is a requirement for enterprise-class UTM. The most appropriate UTM device architectures for enterprise networks are those that have the flexibility to

turn features on while at the same time increasing performance.

When you choose to use UTM features in an enterprise network, you're putting more and more eggs in the same basket. Enterprise-class UTM architecture gives you the flexibility to scale in multiple directions at once and gives the security architect more options, rather than constraints.

Extensibility and flexibility are issues that affect the internal architecture of any UTM device. A naïve UTM implementation will assume that all packets flow through the device in the same way and that the order in which threat management elements, firewall, and VPN see each packet is fixed. Having a rigid order to UTM functions and assuming every packet goes through every enabled function, is an inflexible design not appropriate for enterprise networks.

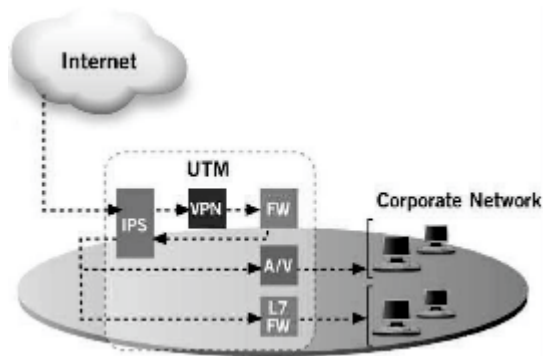
As a simple example, consider the relationship between IPS and firewall services. In some enterprises, security architects have elected to place IPS inside of the firewall to only see legitimate threats passed onto the network. In others, IPS goes outside the firewall to give a better 'big picture' of the threat landscape and the continuing attacks on the network. Enterprise-class UTM devices should have the flexibility to order and reorder (and even duplicate) these functions as needed to meet the needs of the security architecture. When a device doesn't offer the flexibility to see and manage traffic flows, you'll end up adding

threat mitigation boxes on either side of the UTM device anyway — meaning that the UTM device is not really doing its intended job.

#### *Solution vendors specializing in point products*

— Web proxies, IPS, Layer 7 firewalls — have tried to paint UTM as an alternative (and not a very good one) to their “best of breed” solutions. Sometimes this is a ludicrous assertion — how much do Web content filters actually differ and are those differences really wide enough to claim a “best of breed” designation? Where a UTM vendor has restricted the breadth of applications as well as the depth of vendors, there is a bit of truth to this assertion. That's why enterprise-class UTM products must have extensibility in these directions as well.

An important part of choosing a UTM solution is realizing that “threat management” is constantly being re-defined by the market. For every new threat, you have to ask: Is the right solution to scatter additional boxes around the network — the “new day, new threat, new box” style of security? Or, rather, is it to have an extensible platform that can be adjusted to support new types of threats without network re-engineering? In an enterprise network, the latter is obviously the more prudent course.



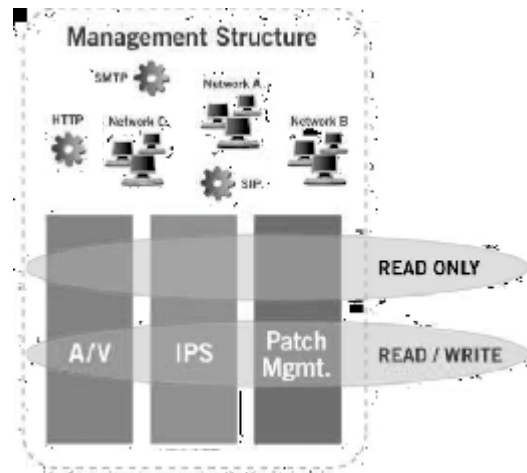
Flexibility in UTM's gives the network architect the option to have security services where they make sense, not in a fixed order. For example, an IPS might see traffic twice: once before it's decrypted to mitigate DoS attacks, and then again after it's passed through the VPN and firewall to look for different types of threats.

## Management Requirements

It's a pleasant thought to imagine that a unified GUI could offer the ability to configure and manage everything from setting up IP routing configurations to weeding through alerts on an IDS console. But the cold, hard reality is that different GUIs exist for a reason — the metaphor, layout, and work flow that you use in defining routing protocols and interface settings is very different from what you use in configuring a virus scanner.

UTM devices must tread this line very carefully and enterprise security architects need to evaluate capabilities with equal care. For example, most SMB UTM devices attempt to shoehorn an IPS console into an existing Web-based GUI. As any IPS manager knows, the requirements for these products are vastly different from those of a firewall, and may not even translate well to a Web-based interface. IPS GUIs are highly interactive, provide drill down and forensics capabilities,

and must be able to manage thousands of rules (as opposed to the tens of rules that might be found on the accompanying firewall). Simply trying to shove the IPS into the firewall GUI inevitably leads to disaster.



Management in enterprise-class UTM requires the flexibility to divide along traditional horizontal boundaries, such as operators, network managers, and auditors, as well as vertical boundaries, such as by function (e.g., anti-virus, firewall, patch management) or by network element (e.g., subnets or buildings or departments). Even when the vertical boundaries require multiple management systems, the use and re-use of common elements such as networks and services will help to ensure a tightly integrated and error-free UTM department.

Disparate GUI styles should not preclude management integration, though. In fact, a desirable enterprise UTM management framework doesn't attempt to integrate all aspects of all GUIs into one dizzying console on your screen. Instead, it keeps the important parts of each function intact, while sharing information and configuration capabilities as broadly as possible.

Separation of management tools is also important in enterprise networks because the engineers who manage different parts of the system are also diverse. In a small business,

a single person might handle all security from desktop to firewall. In an enterprise, these are typically different people sitting on dissimilar teams. An enterprise-class UTM device needs to meet the expectations of each of the security, networking, and desktop management teams which all play a role in managing it.

This situation drives a second management requirement: separation of duties and of powers. Enterprise-class UTM management needs both vertical (function-based) separation — to keep the security people from stomping on the toes of the network people — as well as horizontal (privilege-based) separation — to keep operators from changing things they shouldn't. As regulatory and compliance requirements stretch their evil fingers deeper into each organization, management separation can also be a vital part of this effort.

## Conclusion

UTM products originally were crafted based on the needs of smaller networks and smaller enterprises, and have seen broad acceptance in their large niche of potential installations. However, the concept of UTM has value in large networks and large enterprises as well. To support UTM in large networks, though, products must meet a very different set of requirements that set them apart from SMB-focused UTM firewalls. By going further in the areas of performance, network integration, support for

consolidation, platform extensibility and flexibility, and management, UTM vendors can meet the needs of enterprise network managers. When UTM products reach to meet enterprise needs, the results are a powerful toolset that can displace traditional firewalls and give network managers greater flexibility and greater capability to solve their immediate security problems quickly.

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## **Consumers Buying Behaviour towards Two-Wheeler Motor Bikes**

**Shekhar Chavan**

### **Abstract**

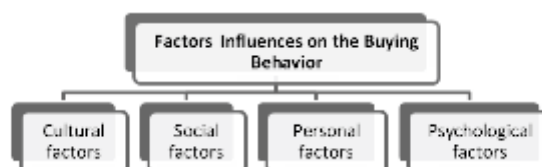
The marketing concept is become conversant with consumer and the prominence is given more on the consumer than on the product manufacture by company. The spirit of modern marketing is not only building the profit but also creating meaningful value satisfaction for the consumers his opinion, needs, requirements and desires have to be harmonized with the set of products and production programmes. Hence, marketing success an organisation depends as its ability to create a community which helps to delight consumers. All the business plans, polices and the activities should be carried out in ways which are directed towards the delighting the consumer needs.

**Keywords:** Consumer Behaviour; Psychological factors, consumer delighting and opinion.

### **Introduction:**

Consumer behavior is affected by a multitude of variables ranging from personal needs, personality characteristics, professional needs, attitudes and values, social, cultural and economic background, gender, age, professional status to social influences of various type exerted a family, colleagues, friends, and society as a totality. The mixture of these factors help the consumer in making the decision, further Psychological factors that as individual consumer needs, perceptions, motivations, attitudes, the process of learning, personality characteristics are the similarities, which functions across the different types of people and influence their behavior.

There are four factors which influences the buying behavior of consumer



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## Consumers Buying Behaviour towards Two-Wheeler Motor Bikes

A study had been conducted on “Consumer Behaviour towards Two-Wheeler Motor Bikes” in Bhor with a sample of 400 consumers by selecting two wheeler motor. The data had been collected through structured questionnaire. Chi Square Test is used in testing of Hypothesis.

### Objectives of the Study:

1. To study the factors of respondents profile in buying a motor bikes.
2. To analyze the impact of Vehicle Characteristics on consumers buying a motor bike.

### Research Design

Sr. No.	Parameter	Description
1	Type of Research	Ex Post Facto Descriptive Research
2	Nature of Research	Qualitative
3	Research Instrument	Structured questionnaire
4	Dependent Variable	Education, Income, Social Background, Employment, Area of resident, characteristics of two wheeler etc.
5	Independent Variable	Buying Behaviour of Two Wheeler
6	Type of Product	Two wheeler
7	Method of Data Collection	Sample Survey Method
8	Population	All people who attained age of majority.
9	Sample Size	400 respondents.
10	Sample Elements	People residing in Bhor
11	Sampling Method	Non probability convenience sampling.
12	Sources of Data Collection	Primary sources
13	Measurement Scales used	Nominal, Ordinal and Interval scale
14	Questions Types	Dichotomous, close ended, multiple responses, ranking and differential scales.
15	Rating Scale	Nominal, ordinal, interval scale.
16	Data interpretation	Through graphs, descriptive statistics and inferential statistics
17	Tools for data analysis	Percentage method, Graphical presentation of data
18	Statistical Software Package	Ms Excel and SPSS (Chi-Square Test).

### Hypothesis Test One:

#### Hypothesis:

H<sub>0</sub> : There is no significant difference in vehicle characteristics like (a) category, (b) age, (c) make and (d) engine cubic capacity on the buying of two-wheeler motor bikes.

H<sub>1</sub> : There is significant difference in vehicle characteristics like (a) category, (b) age, (c) make and (d) engine cubic capacity on the buying of

two-wheeler motor bikes.

The hypotheses have been tested by using Chi Square test.

Table: 1. CHI SQUARE Test Results

Type *	N of Valid Cases	Value	df	Asymp. Sig. (2-sided)	Remarks
Type * TWC	400	6.775 <sup>a</sup>	2	0.034	a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.76.
Type * TWAGE	400	25.836 <sup>a</sup>	3	0.000	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.50.
Type * TWM	400	12.246 <sup>a</sup>	12	0.425	a. 13 cells (50.0%) have expected count less than 5. The minimum expected count is .17.
Type * TWCC	400	18.345 <sup>a</sup>	4	0.001	a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is .34.

Where, Type = Vehicle Characteristics, TWC=Two-wheeler Category, TWAGE= Age of Two-wheeler, TWM=Make or Brand of Two-wheeler and TWCC= Two-wheeler Engine Cubic Capacity.

### Hypotheses Test Result:

As the significance value obtained  $p < 0.05$  in case of vehicle characteristics like (a) category, (b) age and (d) engine cubic capacity, null hypotheses rejected and the alternate hypotheses accepted, while the significance value obtained  $p > 0.05$  in case of vehicle characteristic (c) make of vehicle where null hypotheses is accepted.

**Interpretation regarding vehicle characteristics:** There is significant difference on certain critical vehicle characteristics. Adopters and non-

adopters respondents had significant differences in terms of (a) category; age and (d) engine cubic capacity of their vehicle, while there is no significant difference in terms of © make.

### Hypothesis Test Two:

$H_0$ : There is no difference in demographic factors like (a) age, (b) formal education, (c) gender, (d) marital status, (e) occupation and (f) family monthly take-home income in buying of two-wheeler motor bikes.

$H_1$ : There is significant difference in demographic factors like (a) age, (b) formal education, (c) gender, (d) marital status, (e) occupation and (f) family monthly take-home income in buying of two-wheeler motor bikes.

Where, Type = Demographic Characteristics, AGE=Age of respondents, ED=Educational Qualification, GEN=Gender, MAR = Marital Status, OCN=Occupation and MI= Family Monthly Take-Home Income.

Hypotheses Test Result: As the significance value obtained  $p < 0.05$  in case of demographic factor (e) occupation, null hypothesis is rejected and the alternate hypothesis is accepted, whereas the significance value obtained  $p > 0.05$  in case of demographic factors like (a) age, (b) formal education, (c) gender, (d) marital status, and (f) family monthly take-home income, null hypotheses accepted.

### Interpretation: Demographic Factors

There is significant difference on demographic factor of (e) occupation, as self-employed persons are adopters, while there is no significant difference on other factors like (a) age, (b) formal education, (c) gender, (d) marital status, and (f) family monthly take-home income. As self-employed persons exhibit high levels of risk taking and self confidence, the finding is similar to that of Goldsmith (2001) in terms of dimensions of adopters as innovative customers.

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Type of Demographic Characteristics * Variable	N of Valid Cases	Value	df	Asymp. Sig. (2-sided)	Remarks
Type * AGE	400	5.069 <sup>a</sup>	3	0.167	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.61.
Type * ED	400	1.328 <sup>a</sup>	2	0.515	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.78.
Type * GEN	400	1.179 <sup>a</sup>	1	0.277	a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.55.
Type * MAR	400	.928 <sup>a</sup>	1	0.335	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.60.
Type * OCN	400	8.378 <sup>a</sup>	3	0.039	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.48.
Type * MI	400	3.731 <sup>a</sup>	4	0.444	a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.65.

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***A Co-relational study on Organizational Commitment  
and Organizational Citizenship Behavior  
with reference to Indian Faculties***

**Mitika Mahajan**

**Abstract**

In today's competitive era, the organizations are facing so many HR challenges. One of the challenges faced in human resource aspect is employees' unwillingness to work apart from their said duties and contribute to organizational efficiency and growth. Today organizations need the employees who do work beyond their job descriptions for the survival and growth of the organization. This volunteer behaviour of the employees is called organizational citizenship behaviour. Studies show that Organization Citizenship Behaviour is the outcome of Organizational Commitment. In present research paper the prime focus is to identify the correlation between Organization Citizenship Behaviour and Organizational Commitment. Moreover whether any influence of gender and time span in the organization as an employee is there or not is recognized. For achieving the objectives the questionnaires are sent to Indian faculties through mail and analyzed using SPSS and advanced excel.

**Keywords:**

Organizational Commitment, Organization Citizenship Behaviour, Commitment and its types

**Introduction**

In cutthroat competition, the Indian institutions for higher education are facing the challenges in managing their human resource i.e. faculty members. In current scenario the arguments are there that academicians are not committed to the institutions or even profession. They choose this profession because they do not have other alternatives though the research survey findings suggest totally opposite to this assumptions. The research on faculties' commitment and citizenship behaviour shows that the teachers have positive attitude towards citizenship behaviour and commitment. In India the research related to the relationship between

organizational citizenship behaviour and organization commitment on faculties of higher education is untouched. This paper is an attempt to uncover this research area.

Organizational citizenship behaviour is one of the fascinated areas for researchers from last decade. Around 25 years old concept has gained a lot of interest for researchers and managers. OCB now is not limited to only behavioural science but it has expanded its boundaries to different domains and disciplines such as human resource management, leadership, international management, marketing, hospital and health administration, and economics. OCB is discretionary that means it is not mandatory for the employees. Secondly it is not recognized by the reward system of the organization so it is not intended for the reward from the organization and third and might be the most important that it promotes effective functioning of the organization to achieve its goals.

Organization commitment is defined as an attitude of the employees to remain a member of the particular organization. It is the desire of the employees to associate with the organization for a longer period. Today in such fierce competition, organizations need the employees which have high commitment level as the committed employees are more efficient and effective in their job which ultimately benefits the organization for their growth. The committed employees play a significant role in the organization's level of achievement. (Meyer and

Allen 1993)

This paper examines the relationship between OCB and OC for the faculties of Indian Institutes. The commitment level of Indian faculties are identifies and it shows positive results. The area of research for the faculty members in OCB and OC is still untouched. It instigates us to examine the relationship.

### **Literature Review**

John P. Meyer, David J. Stanley, Lynne Herscovitch, and Laryssa Topolnytsky (2002) in their research found that affective ( $r = 0.32$ ) and normative ( $r = 0.24$ ) commitment correlated positively with Organizational Citizenship Behaviour, whereas the correlation with continuance commitment was near zero. In their Meta-analysis they found the correlation coefficient of affective and normative commitment with both altruism and compliance were between 0.20 and 0.26. Thus their research draws a positive relationship between Organizational Citizenship Behaviour and affective and normative commitment and a negative or zero relationship between Organizational Citizenship Behaviour and continuance commitment.

According to the results of Ayesha Noor (2009) in her research on faculties of Pakistani Universities the Organizational commitment is closely related to the Organizational Citizenship Behaviour. The correlation coefficient for the research was 0.800 while beta value

for the same was 0.800. This shows the strong relationship between Organizational Citizenship Behaviour and OC.

Shore and Wanger (1993) found in their study that Affective and Normative commitments are positively related to the organizational citizenship behaviour while continuance commitment is negatively related to the Organizational Citizenship Behaviour. Moreover they concluded that affective commitment and normative commitment are positively connected to the performance and continuance commitment is negatively connected to the performance.

Arti Bakhshi Atul Dutt Sharma (corresponding author) Kuldeep Kumar (2011) study on organizational commitment and organizational citizenship behaviour results suggest that only normative commitment has the impact on Organizational Citizenship Behavior to some extent ( $r=0.258$ ,  $p < 0.05$ ). Affective commitment and continuance commitment has no impact on Organization Citizenship Behaviour.

Sofiah Kadar Khan and Mohd Zabid Abdul Rashid their study on relationship between Organizational Citizenship Behaviour and Organizational commitment (April 2012) derived that organization commitment has significant impact on Organizational Citizenship Behaviour. The beta value for this

study was 0.299.

### **Organizational Citizenship Behaviour**

Successful organizations need employees who will do more than their usual job duties- who will provide performance that is beyond expectations. In today's dynamic workplace, where tasks are increasingly done in terms and where flexibility is critical, organizations need employees who will engage in "good citizenship" behaviour such as helping others in a team, volunteering for extra work, avoiding unnecessary conflicts, respecting their spirit as well as the letters of rules and regulations, and gracefully tolerating the occasional work related impositions. (Robins)

Organizational Citizenship Behaviour has two dimensions. One is interpersonal (OCB-I) and the other is organizational (OCB-O). This was based on the target of the behaviours. If the target of behaviour is individual it is called as OCB-I and if it is for the organization as a whole it is called is OCB-O. For example if the employee voluntarily help a co-worker it will be OCB-I and if the employee is praising the organization to outsiders it will be OCB-O. In this paper these two dimensions are also examined and correlated.

### **Organizational Commitment**

Organizational commitment is defined as a state in which an employee identifies with a particular

organization and its goals and wishes to maintain membership in the organization. There are three separate dimensions of organizational commitment. (Robins)

1. **Affective Commitment:** an emotional attachment to the organization.
2. **Continuance Commitment:** The perceived economic value of remaining with an organization compared to leaving it. An employee may be committed to the organization because he/she feels that it would hurt to her family.
3. **Normative Commitment:** an obligation to remain with the organization for moral or ethical reasons.

In this paper these three dimensions are taken into considerations.

### **Research Objectives**

To examine the relationship between Organizational Citizenship Behaviour (Two dimensions) and Organizational commitment (Three Dimensions)

### **Hypotheses**

$H_0$ : There is no significant relationship between Organizational commitment and Organizational Citizenship Behaviour

$H_a$ : There is significant relationship between Organizational commitment and Organizational Citizenship Behaviour

### **Research Methodology**

#### *Sample:*

Sample of 68 faculty members from different private higher education institutions of India is taken for the analysis. The questionnaires are sent to the respondents through e-mail and professional networking sites.

#### *Measures:*

**Organizational Citizenship Behaviour scale:** For analyzing Organizational Citizenship Behaviour Suzy Fox and Paul E Spector (2011) scale is adopted.

**Organizational Commitment scale:** For analyzing OC some questions from Revised Version (Meyer, Allen, & Smith, 1993) is adopted.

#### *Results*

The reliability of the scale is measured by Cronbach's Alpha. 0.683 value of the Cronbach's alpha shows that the scale is reliable.

Table: 1 Reliability Statistics (Cronbach's Alpha)

Reliability Statistics	
Cronbach's Alpha	N of Items
.683	15

**Analysis of Correlation:** The correlation between different variables is done through Pearson's correlation. The results show that correlation between Affective commitment and Organizational Citizenship Behaviour -I and Organizational Citizenship



Behaviour -O is weak (0.201 and 0.275 respectively). Continuance commitment and Organizational Citizenship Behaviour -I and Organizational Citizenship Behaviour -O correlation is also weak (0.185 and 0.070 respectively) while the correlation between normative commitment and Organizational Citizenship Behaviour -I is weak and shows negative correlation. Normative commitment and Organizational Citizenship Behaviour -O also does not show strong correlation (0.102).

Table: 2 Value of Correlation Coefficient ®

	Organizational Citizenship Behaviour- I	Organizational Citizenship Behaviour- O
Affective Commitment	.201	.275
Continuance Commitment	.185	.070
Normative Commitment	-.036	.102

### *Hypothesis testing:*

To test the hypothesis of correlation between two variables t-test has been adopted at 95% confidence interval. The t value for the test is calculated by following equation.

$$t = \frac{r - p}{SE}$$

$$t = r * \frac{\sqrt{(n-2)}}{\sqrt{(1-r^2)}}$$

Where r= Sample correlation coefficient

SE=Standard Error of correlation coefficient

Table: 3 Calculated Values of t

	Organizational Citizenship Behaviour- I	Organizational Citizenship Behaviour- O
Affective Commitment	1.667	2.324
Continuance Commitment	1.529	0.570
Normative Commitment	-0.293	0.833

### **Interpretation:**

The calculated t values for various variables at 95% confidence interval are shown in table 3. The table value for the same is 1.997. The results show that only in one case the null hypothesis is rejected i.e. the relationship between Affective Commitment and Organizational Citizenship Behaviour -O. In all other cases the null hypothesis is accepted that shows that there is no significant relationship between the variables. There is no relationship between Organizational commitment and Organizational Citizenship Behaviour -I.

### **Conclusion:**

From the research done on 68 faculty members of various universities of India we can say that the emotional attachment towards the organization has some relation with the OCB-O i.e. citizenship behaviour for the whole organization. This results show that Organizational commitment and OCB is not correlated. The commitment and the citizenship behaviour are on separate way. One justification for these results can be that some other variables must be affected to the OCB. This encourages us to study more on factors responsible for OCB and Organizational commitment. These

variables can be the behaviour of supervisor or the policies of the organization. The employees may be motivated to work voluntarily due to motivational factors (Herzberg Two factor theory).

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## ***Modeling of Microchannel Integrated Cantilever for Ultra-Sensitive Detection of Biomacromolecules***

**Ravindra Sarje**

**Abstract:** This paper presents the modelling of microchannel integrated with cantilever for weight measurement of bio macromolecules, or any other micro sized particles. Design and simulation of the device is carried out using COMSOL Multiphysics software with a view to fabricate the same using LTCC technology. The idea behind the sensing of bio macromolecules is the bending of the cantilever beam due to its weight. The weight of the entity exerts pressure on the tip of the cantilever making it bend and generate stress in the beam. This stress or bending is found to be directly proportional to the mass of the biomacromolecule.

**Keywords:** Cantilever, Microfluidics, LTCC, biosensor

### **Introduction**

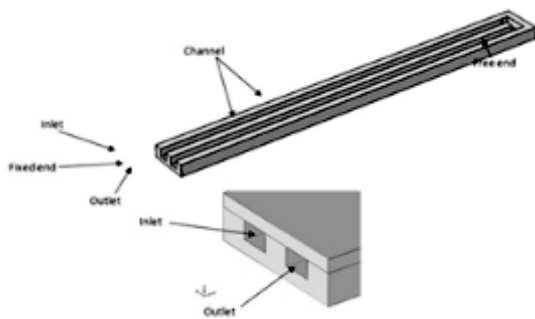
With the advent of MEMS technology, devices have become smaller, functionalities can be embedded into one system and also the sensitivity and rapidness of the systems can be enhanced. The MEMS devices in the form of cantilever beams, gyroscopes, accelerometers, diaphragms find immense applications in variety of fields. Further MEMS merged with microfluidics [1] have opened a new domain of research area where detection of tiny molecules is feasible [1]. These devices can be of help to early detection of biowarfare agents, diseases, pathogens [2-3] etc.

MEMS technology uses mechanical elements like cantilever beams, diaphragms for sensing. Cantilever is a device which is fixed at one end and free at the other end. Though cantilever is a mechanical structure, it can be put to use as physical, chemical or biological sensor [4]. It is proved that micro-cantilevers if designed properly, can exhibit sensitivity to mechanical operation [5]. Compared to other mechanical structures, cantilevers are relatively easy to fabricate in silicon as well as in LTCC technology.

The present paper deals with design and modeling of cantilever coupled microchannel. This process not only

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enhances the sensitivity of the cantilever by removing extra material, but also provides a domain to sense in-flow agents. Attempt is made to couple microfluidics with a mechanical structure to design an ultra-sensitive biosensor and fabricate using LTCC technology. The schematic of the device is given in Fig. 1. And zoom view of inlet and outlet is shown in inset.



*Figure 1: Schematic of the Device*

### **Design And Theoretical Background**

The device is modelled using COMSOL Multiphysics finite element modelling technique. For all the simulations structural material is considered to be LTCC and water as fluid medium. “COMSOL Multiphysics” is used as it can design and simulate different devices using modules like, MEMS, CFD, and FSI. It can generate coupled results also. In this design, cantilever is fixed at one end and free at other end with microchannel embedded in it. Stoney's formula is useful to calculate deflection of free end of cantilever ( $d$ ) to applied stress ( $s$ ) (Eq. 1) [6-7]

$$d = 3s (1 - \nu) \frac{L^3}{Et^2} \dots \dots \text{Eq.1}$$

Where ' $\nu$ ' is Poisson ratio,  $E$  is young's Modulus,  $L$  is length of beam and  $t$  is the cantilever thickness (height)

The pressure exerted on the cantilever can be calculated by using following formulae

$$P = F/A. \dots \dots \text{Eq.2}$$

Where ' $P$ ' is pressure in Pascal, ' $F$ ' is force, ' $A$ ' Area of the microchannel.

Force  $F$  is calculated using Following Formula

$$W = F = m * g \dots \dots \text{Eq.3}$$

Where ' $W$ ' is weight, ' $F$ ' is force ' $m$ ' is mass and ' $g$ ' is gravitational force.

Further mass is calculated by use of Eq. 4.

$$m = d * v \dots \dots \text{Eq.4}$$

Where ' $m$ ' is mass, ' $d$ ' is density and ' $v$ ' is volume.

Considering the larger sensitivity requirements of the device and LTCC technology limitations the cross section of the microfluidic channel is taken to be  $50 \mu\text{m} \times 35 \mu\text{m}$ . If the typical length of the channel is taken to be  $40 \text{ mm}$  and is filled with water the pressure exerted will be  $\sim 3.4 \text{ Pa}$ . Further the pressure exerted by single biological cell is typically of the order of  $1 \text{ pPa}$ .

As pressure exerted on the cantilever by a single cell is very small the

corresponding tip deflections will also be small. It is therefore necessary to change the dimensions of the device and find out through simulations the optimum dimensions to give measurable tip deflection. The results on simulations are given in the next section.

### **Simulation Results and Discussion**

This microfluidic channel is embedded in the cantilever is shown in Fig.1. In addition to channel dimensions given in previous section Length, Width and Thickness of the cantilever are the other dimensions of interest. It is planned to design and fabricate the structure in LTCC technology. Therefore considering the raw material dimensions (green tapes), minimum separation between the two channels and the width of end walls the total width of the cantilever is set at 250  $\mu\text{m}$ . Simulations were carried out by changing Length and Thickness of the cantilever. Simulations are carried out for finding out the pressure exerted by the fluid and the corresponding deflection.

A material used for simulation of this device is LTCC (Low Temperature Co-fired Ceramic) with the Young's modulus -152 GPa, Poisson's ratio - 0.24 and Density - 3100  $\text{kg/m}^3$  [8]. And for Water Dynamic viscosity  $1 \times 10^{-3}$  Pa.s and Density 1000  $\text{kg/m}^3$  is taken.

Mechanical and fluidics simulation carried out separately. For simulation of device physics controlled normal

meshing is used. Table 4 shows the meshing details.

Table 1: Meshing Details

Name	Value
Maximum element size	2000
Minimum element size	360
Curvature factor	0.6
Resolution of narrow regions	0.5
Maximum element growth rate	1.5

Figure below shows simulated results for displacement, stress and microfluidics analysis

#### *Mechanical simulation*

Mechanical simulations were carried out for different dimensions of the cantilever. Cross-section of the microfluidic channel and the width of the cantilever are kept constant. Table – shows the tip deflection of the cantilever as a function of cantilever dimensions for the applied pressure of 1 pico pascal (typically exerted by single biocell).

Table 2 – Observation of different sized cantilever for design optimization for 1 Pico Pascal and 100 Pico Pascal of pressure.

Obs	Length	Thickness μm	Displacement meters
<b>For 1 Pico Pascal</b>			
1	20000	150	4.75e-19
2	1000	105	8.7e-24
3	1500	105	4.23e-23
4	5000	105	5.36e-21
5	10000	105	8.64e-20
6	15000	105	4.38e-19
7	20000	105	1.35e-18
8	15000	85	8.63e-19
9	20000	85	2.53e-18
<b>For 100 Pico Pascal</b>			
10	15000	150	4.32e-18
11	20000	150	4.72e-17
12	15000	85	6.37e-17
13	20000	85	1.38e-16

As can be seen from the table increase in the length of the cantilever, for constant thickness, increases the tip deflection. The maximum deflection of 1.35e-18 meters is seen for length of 20000 μm. To increase the deflection further width of the cantilever is reduced to 85 μm and the deflection observed is 2.53e-18 meters. It is reported that this deflection is measurable with the help of optical methods. Table 5 also shows deflections obtained for the pressure of 100 Pico Pascal (for 100 biocells) for 20000 μm length of the cantilever. The deflection is seen to be increasing indicating that the structure can be used for the measurement of growth rate of biocells.

A simulated result of displacement of the cantilever for 2 pico pascal pressure (typical weight of single biomolecule) of the biomolecule is shown in Fig 2. Blue color shows the minimum deflection area of the

cantilever where Red color show maximum deflected area of the cantilever

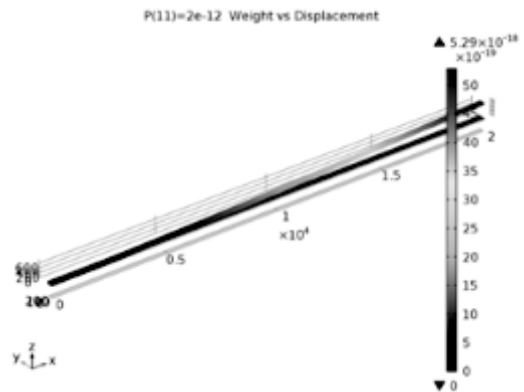


Figure 2: Weight vs. Displacement

The result verifies the Hooke's law [6-7] which state that stress is directly proportional to the strain.

$$F = -kx \dots\dots \text{Eq. 5}$$

Where x is displacement, F is the restoring force, k is the spring constant.

Bending of beam with different weights is shown in figure 3. The graph shows linear increase of displacement with change in weight (pressure varied from 1 to 1 pPa). This is essential as the design of the beam is targeted for an ultra-sensitive sensor.



Figure 3: Weight vs. Displacement (variable weight)

Figure 4 shows the weight vs. stress relation. The figure depicts the stress gradient generated due to the applied pressure. The maximum stress is observed near the fixed end of the cantilever beam where resistor can be doped to have a sensitive detection system.

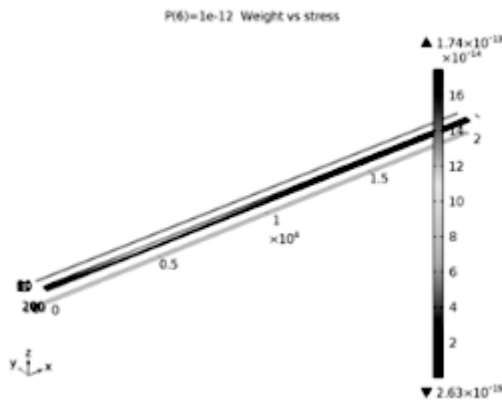


Figure 4: weight vs. stress

Figure 5 shows variable weight vs. generated stress. The graph shows increase in stress region with increase in weight. The stresses generated are of very small order as the weight of the liquid exerting pressure is not very large. There is a linear increment in stress with weight which is desirable of a sensitive sensor.

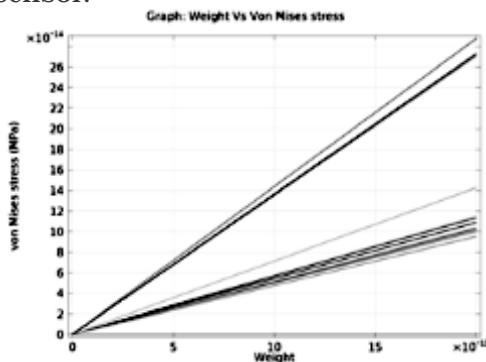


Figure 5: Variable weight vs. stress

### Fluidics Simulation

Optimized design for simulation of microfluidics is shown below. Figure 6 shows actual optimized microfluidics design and Figure 7 shows the enlarged view.

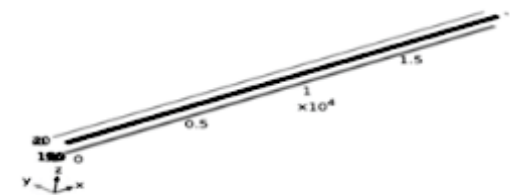


Figure 6: optimized design of microfluidics channel

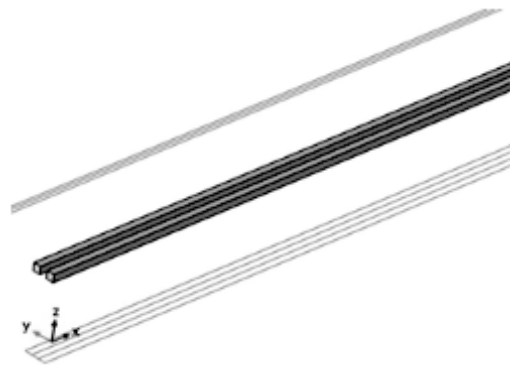


Figure 7: Enlarge view of microfluidics channel.

The liquid is allowed to flow from the inlet of the channel at a velocity of 100[μm/s]. All the simulations use this as a flow rate and the following results are obtained.

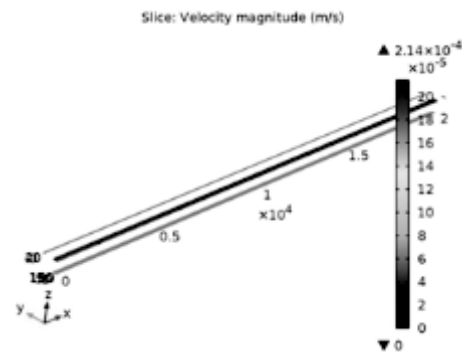


Figure 8: velocity magnitude.

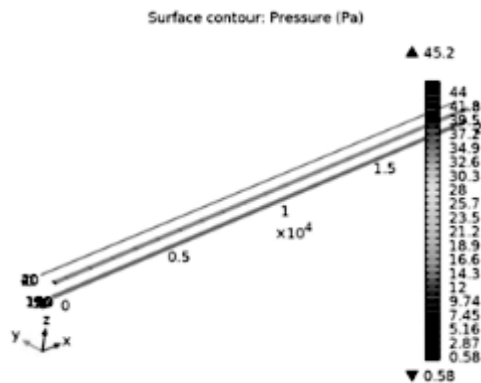


Figure 9: Pressure due to flow of water

It is evident from the Figure 8 and 9 that as the velocity increases, pressure exerted on the tip increases. The pressure varies with the viscosity of the liquid as well. As number of biomacromolecules is encountered there will be linear displacement of the cantilever beam ensuring a sensitive sensor. This sensor design can be employed to capture in-flow measurement of molecules and can be extended to classify a particular macromolecule based on its weight.

## Conclusion

Microchannel integrated cantilever is designed and simulated for weight measurement of various bio macromolecules, or any other micro sized particles. The simulations are carried out for in-flow bending of cantilever. The results show that a very small amount of displacement of beam is observed while pressure is exerted on the beam at its tip. A stress gradient is generated on beam which could be used for detection of the very small displacement. The bending is directly proportional to the weight of the water at the tip which proves its

usage as a very sensitive biosensor.

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**Abstract**

E-waste is a popular, informal name for electronic products nearing the end of their "useful life." E-wastes are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem. This paper highlights the hazards of e-wastes, the need for its appropriate management and options that can be implemented.

Keyword-E-waste, hazardous, density, refurbished, recycle

**Introduction**

Over the past two decades, the global market of electrical and electronic equipment (EEE) continues to grow exponentially, while the lifespan of those products becomes shorter and shorter. Therefore, business as well as waste management officials are facing a new challenge, and e-Waste or waste electrical and electronic equipment (WEEE) is receiving considerable amount of attention from policy makers. Predictably, the number of electrical devices will continue to increase on the global scale, and microprocessors will be used in ever-increasing numbers in daily objects [1, 2]. (i)In the United States (US) market, less than 80 million communication devices were sold in 2003; the number was expected to exceed 152 million by 2008 [3], a growth of over 90 percent in 5 years. Meanwhile, in 2006, more than 34 million TVs have been exposed in the market, and roughly 24 million PCs and

139 million portable communication devices have been produced [4]. (ii) In the European Union (EU), the total units of electronic devices placed on the market in 2009 were more than 3.8 billion units, including 265 million computers, roughly 245 million in home consumer electronics, and 197 million consumer appliances (major), [5]. (iii) In China, approximately 20 million refrigerators and more than 48 million TVs were sold in 2001, and nearly 40 million PCs were sold in 2009 [6]. Furthermore, the growth rate is increasing every year [7].

Compared to conventional municipal wastes, certain components of electronic products contain toxic substances, which can generate a threat to the environment as well as to human health [9, 10]. For instance, television and computer monitors normally contain hazardous materials such as lead, mercury, and cadmium, while nickel, beryllium, and zinc can often be found in circuit boards. Due to the presence of these substances, recycling and disposal of e-Waste becomes an important issue.

### **Definition of E-waste**

As a popular and informal term, electronic waste (e-Waste) is loosely refers to any white goods, consumer and business electronics, and information technology hardware that is in the end of its useful life. Specifically, Puckett et al. [13] define e-waste as “a broad and growing range of electronic devices ranging from large household devices such as

refrigerators, air conditions, cell phones, personal stereos, and consumer electronics to computers which have been discarded by their users”. According to Sinha-Khetriwal [14], “e-Waste can be classified as any electrical powered appliance that has reached its end-of-life”.

### **Effects on Environment and Human Health**

Disposal of e-wastes is a particular problem faced in many regions across the globe. Computer wastes that are landfilled produces contaminated leachates which eventually pollute the groundwater. Acids and sludge obtained from melting computer chips, if disposed on the ground causes acidification of soil. For example, Guiyu, Hong Kong a thriving area of illegal e-waste recycling is facing acute water shortages due to the contamination of water resources.

This is due to disposal of recycling wastes such as acids, sludges etc. in rivers. Now water is being transported from faraway towns to cater to the demands of the population. Incineration of e-wastes can emit toxic fumes and gases, thereby polluting the surrounding air. Improperly monitored landfills can cause environmental hazards. Mercury will leach when certain electronic devices, such as circuit breakers are destroyed. The same is true for polychlorinated biphenyls (PCBs) from condensers. When brominated flame retardant plastic or cadmium containing plastics are

landfilled, both polybrominated-diphenyl ethers (PBDE) and cadmium may leach into the soil and groundwater. It has been found that significant amounts of lead ion are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, gets mixed with acid waters and are a common occurrence in landfills. Not only does the leaching of mercury poses specific problems, the vaporization of metallic mercury and dimethylene mercury, both part of Waste Electrical and Electronic Equipment (WEEE) is also of concern. In addition, uncontrolled fires may arise at landfills and this could be a frequent occurrence in many countries. When exposed to fire, metals and other chemical substances, such as the extremely toxic dioxins and furans (TCDD tetrachlorodibenzo-dioxin, PCDDs-polychlorinated dibenzo-dioxins. PBDDs-polybrominate-ddibenzo-dioxin and PCDFspoly chlorinated dibenzo furans) from halogenated flame retardant products and PCB containing condensers can be emitted. The most dangerous form of burning e-waste is the open-air burning of plastics in order to recover copper and other metals. The toxic fall-out from open air burning affects both the local environment and broader global air currents, depositing highly toxic by products in many places throughout the world.

If these electronic items are discarded with other household garbage, the toxics pose a threat to both health and vital components of

the ecosystem. In view of the ill-effects of hazardous wastes to both environment and health, several countries exhorted the need for a global agreement to address the problems and challenges posed by hazardous waste. Also, in the late 1980s, a tightening of environmental regulations in industrialized countries led to a dramatic rise in the cost of hazardous waste disposal. Searching for cheaper ways to get rid of the wastes, "toxic traders" began shipping hazardous waste to developing countries. International outrage following these irresponsible activities led to the drafting and adoption of strategic plans and regulations at the Basel Convention. The Convention secretariat, in Geneva, Switzerland, facilitates and implementation of the Convention and related agreements. It also provides assistance and guidelines on legal and technical issues, gathers statistical data, and conducts training on the proper management of hazardous waste. Most people are unaware of the potential negative impact of the rapidly increasing use of computers, monitors, and televisions. When these products are placed in landfills or incinerated, they pose health risks due to the hazardous materials they contain. The improper disposal of electronic products leads to the possibility of damaging the environment. As more e-Waste is placed in landfills, exposure to environmental toxins is likely to increase, resulting in elevated risks of cancer and developmental and neurological disorders. A major driver of the

growing e-Waste problem is the short lifespan of most electronic products—less than two years for computers and cell phones [11, 12]. In a 2006 report, the International Association of Electronics Recyclers projected that, with the current growth and obsolescence rates of the various categories of consumer electronics, somewhere in the neighborhood of 3 billion units would be scrapped by 2010 or an average of about 400 million units a year.

### **Basel Convention**

The fundamental aims of the Basel Convention are the control and reduction of trans boundary movements of hazardous and other wastes including the prevention and minimization of their generation, the environmentally sound management of such wastes and the active promotion of the transfer and use of technologies. A set. of interrelated and mutually supportive strategies are proposed to support the concrete implementation of the activities as indicated in the website ([www.basel.int/DraftstrateKJcplan4Seot.pdf](http://www.basel.int/DraftstrateKJcplan4Seot.pdf)) is described below:

- To involve experts in designing communication tools for creating awareness at the highest level to promote the aims of the Basel Declaration on environmentally sound management and the ratification and implementation of the Basel Convention, its amendments and protocol with the emphasis on the short-term activities.
- To engage and stimulate a group of

interested parties to assist the secretariat in exploring fund raising strategies including the preparation of projects and in making full use of expertise in non-governmental organizations and other institutions in joint projects.

- To motivate selective partners among various stakeholders to bring added value to making progress in the short-term.
- To disseminate and make information easily accessible through the internet and other electronic and printed materials on the transfer of know-how, in particular through Basel Convention Regional Centers (BCRCs).

To collaborate with existing institutions and programmes to promote better use of cleaner technology and its transfer, methodology, economic instruments or policy to facilitate or support capacity-building for the environmentally sound management of hazardous and other wastes..The Basel Convention brought about a respite to the transboundary movement of hazardous waste. India and other countries have ratified the convention. However United States (US) is not a party to the ban and is responsible for disposing hazardous waste, such as, e-waste to Asian countries even today. Developed countries such as US should enforce stricter legislations in their own country for the prevention of this horrifying act.

In the European Union where the

annual quantity of electronic waste is likely to double in the next 12 years, the European Parliament recently passed legislation that will require manufacturers to take back their electronic products when consumers discard them. This is called Extended Producer Responsibility. It also mandates a timetable for phasing out most toxic substances in electronic products.

### **Management of E-wastes**

It is estimated that 75% of electronic items are stored due to uncertainty of how to manage it. These electronic junks lie unattended in houses, offices, warehouses etc. and normally mixed with household wastes, which are finally disposed off at landfills. This necessitates implementable management measures.

In industries management of e-waste should begin at the point of generation. This can be done by waste minimization techniques and by sustainable product design. Waste minimization in industries involves adopting:

- inventory management,
- production-process modification,
- volume reduction,
- recovery and reuse.

### *Inventory management*

Proper control over the materials used in the manufacturing process is an important way to reduce waste generation (Freeman, 1989). By reducing both the quantity of hazardous materials used in the process and the amount of excess raw materials in stock, the quantity of

waste generated can be reduced. This can be done in two ways i.e. establishing material-purchase review and control procedures and inventory tracking system.

Developing review procedures for all material purchased is the first step in establishing an inventory management program. Procedures should require that all materials be approved prior to purchase. In the approval process all production materials are evaluated to examine if they contain hazardous constituents and whether alternative non-hazardous materials are available.

Another inventory management procedure for waste reduction is to ensure that only the needed quantity of a material is ordered. This will require the establishment of a strict inventory tracking system. Purchase procedures must be implemented which ensure that materials are ordered only on an as-needed basis and that only the amount needed for a specific period of time is ordered.

### *Production-process modification*

Changes can be made in the production process, which will reduce waste generation. This reduction can be accomplished by changing the materials used to make the product or by the more efficient use of input materials in the production process or both. Potential waste minimization techniques can be broken down into three categories: i) Improved operating and maintenance procedures, ii) Material change and

### iii) Process-equipment modification.

Improvements in the operation and maintenance of process equipment can result in significant waste reduction. This can be accomplished by reviewing current operational procedures or lack of procedures and examination of the production process for ways to improve its efficiency. Instituting standard operation procedures can optimise the use of raw materials in the production process and reduce the potential for materials to be lost through leaks and spills. A strict maintenance program, which stresses corrective maintenance, can reduce waste generation caused by equipment failure. An employee-training program is a key element of any waste reduction program. Training should include correct operating and handling procedures, proper equipment use, recommended maintenance and inspection schedules, correct process control specifications and proper management of waste materials.

Hazardous materials used in either a product formulation or a production process may be replaced with a less hazardous or non-hazardous material. This is a very widely used technique and is applicable to most manufacturing processes. Implementation of this waste reduction technique may require only some minor process adjustments or it may require extensive new process equipment. For example, a circuit board manufacturer can replace

solvent-based product with water-based flux and simultaneously replace solvent vapor degreaser with detergent parts washer.

Installing more efficient process equipment or modifying existing equipment to take advantage of better production techniques can significantly reduce waste generation. New or updated equipment can use process materials more efficiently producing less waste. Additionally such efficiency reduces the number of rejected or off-specification products, thereby reducing the amount of material which has to be reworked or disposed of. Modifying existing process equipment can be a very cost-effective method of reducing waste generation. In many cases the modification can just be relatively simple changes in the way the materials are handled within the process to ensure that they are not wasted. For example, in many electronic manufacturing operations, which involve coating a product, such as electroplating or painting, chemicals are used to strip off coating from rejected products so that they can be recoated. These chemicals, which can include acids, caustics, cyanides etc are often a hazardous waste and must be properly managed. By reducing the number of parts that have to be reworked, the quantity of waste can be significantly reduced.

### *Volume reduction*

Volume reduction includes those techniques that remove the hazardous portion of a waste from a

non-hazardous portion. These techniques are usually to reduce the volume, and thus the cost of disposing of a waste material. The techniques that can be used to reduce waste-stream volume can be divided into 2 general categories: source segregation and waste concentration. Segregation of wastes is in many cases a simple and economical technique for waste reduction. Wastes containing different types of metals can be treated separately so that the metal value in the sludge can be recovered. Concentration of a waste stream may increase the likelihood that the material can be recycled or reused. Methods include gravity and vacuum filtration, ultra filtration, reverse osmosis, freeze vaporization etc. For example, an electronic component manufacturer can use compaction equipments to reduce volume of waste cathode ray-tube.

#### *Recovery and reuse*

This technique could eliminate waste disposal costs, reduce raw material costs and provide income from a salable waste. Waste can be recovered on-site, or at an off-site recovery facility, or through inter industry exchange. A number of physical and chemical techniques are available to reclaim a waste material such as reverse osmosis, electrolysis, condensation, electrolytic recovery, filtration, centrifugation etc. For example, a printed-circuit board manufacturer can use electrolytic recovery to reclaim metals from copper and tin-lead plating bath. However recycling of hazardous

products has little environmental benefit if it simply moves the hazards into secondary products that eventually have to be disposed of. Unless the goal is to redesign the product to use nonhazardous materials, such recycling is a false solution.

#### *Sustainable product design*

Minimization of hazardous wastes should be at product design stage itself keeping in mind the following factors\*

**Rethink the product design:** Efforts should be made to design a product with fewer amounts of hazardous materials. For example, the efforts to reduce material use are reflected in some new computer designs that are flatter, lighter and more integrated. Other companies propose centralized networks similar to the telephone system.

**Use of renewable materials and energy:** Bio-based plastics are plastics made with plant-based chemicals or plant-produced polymers rather than from petrochemicals. Bio-based toners, glues and inks are used more frequently. Solar computers also exist but they are currently very expensive.

**Use of non-renewable materials that are safer:** Because many of the materials used are non-renewable, designers could ensure the product is built for re-use, repair and/or upgradeability. Some computer manufacturers such as Dell and Gateway lease out their products thereby ensuring they get them back to further upgrade and lease out



again.

### **The Indian Scenario**

While the world is marveling at the technological revolution, countries like India are facing an imminent danger. E-waste of developed countries, such as the US, dispose their wastes to India and other Asian countries. A recent investigation revealed that much of the electronics turned over for recycling in the United States ends up in Asia, where they are either disposed of or recycled with little or no regard for environmental or worker health and safety. Major reasons for exports are cheap labour and lack of environmental and occupational standards in Asia and in this way the toxic effluent of the developed nations 'would flood towards the world's poorest nations. The magnitude of these problems is yet to be documented. However, groups like Toxic Links India are already working on collating data that could be a step towards controlling this hazardous trade.

It is imperative that developing countries and India in particular wake up to the monopoly of the developed countries and set up appropriate management measures to prevent the hazards and mishaps due to mismanagement of e-wastes.

### **Management Options**

Considering the severity of the problem, it is imperative that certain management options be adopted to

handle the bulk e-wastes. Following are some of the management options suggested for the government, industries and the public.

#### *Responsibilities of the Government*

(i) Governments should set up regulatory agencies in each district, which are vested with the responsibility of co-ordinating and consolidating the regulatory functions of the various government authorities regarding hazardous substances.

(ii) Governments should be responsible for providing an adequate system of laws, controls and administrative procedures for hazardous waste management (Third World Network, 1991). Existing laws concerning e-waste disposal be reviewed and revamped. A comprehensive law that provides e-waste regulation and management and proper disposal of hazardous wastes is required. Such a law should empower the agency to control, supervise and regulate the relevant activities of government departments.

Under this law, the agency concerned should

- Collect basic information on the materials from manufacturers, processors and importers and to maintain an inventory of these materials. The information should include toxicity and potential harmful effects.
- Identify potentially harmful substances and require the industry to test them for adverse health and environmental effects.

- Control risks from manufacture, processing, distribution, use and disposal of electronic wastes.
- Encourage beneficial reuse of "e-waste" and encouraging business activities that use waste". Set up programs so as to promote recycling among citizens and businesses.
- Educate e-waste generators on reuse/recycling options

(iii) Governments must encourage research into the development and standard of hazardous waste management, environmental monitoring and the regulation of hazardous waste-disposal.

(iv) Governments should enforce strict regulations against dumping e-waste in the country by outsiders. Where the laws are flouted, stringent penalties must be imposed. In particular, custodial sentences should be preferred to paltry fines, which these outsiders / foreign nationals can pay.

(v) Governments should enforce strict regulations and heavy fines levied on industries, which do not practice waste prevention and recovery in the production facilities.

(vi) Polluter pays principle and extended producer responsibility should be adopted.

(vii) Governments should encourage and support NGOs and other organizations to involve actively in solving the nation's e-waste problems.

(viii) Uncontrolled dumping is an unsatisfactory method for disposal of hazardous waste and should be phased out.

(viii) Governments should explore opportunities to partner with manufacturers and retailers to provide recycling services.

#### *Responsibility and Role of industries*

1. Generators of wastes should take responsibility to determine the output characteristics of wastes and if hazardous, should provide management options.

2. All personnel involved in handling e-waste in industries including those at the policy, management, control and operational levels, should be properly qualified and trained. Companies can adopt their own policies while handling e-wastes. Some are given below:

Use label materials to assist in recycling (particularly plastics).

Standardize components for easy disassembly.

Re-evaluate 'cheap products' use, make product cycle 'cheap' and so that it has no inherent value that would encourage a recycling infrastructure.

Create computer components and peripherals of biodegradable materials.

Utilize technology sharing particularly for manufacturing and de manufacturing.

Encourage / promote / require green procurement for corporate buyers..

3. Companies can and should adopt waste minimization techniques, which will make a significant reduction in the quantity of e-waste

generated and thereby lessening the impact on the environment. It is a "reverse production" system that designs infrastructure to recover and reuse every material contained within e-wastes metals such as lead, copper, aluminum and gold, and various plastics, glass and wire. Such a "closed loop" manufacturing and recovery system offers a win-win situation for everyone, less of the Earth will be mined for raw materials, and groundwater will be protected, researchers explain.

4. Manufacturers, distributors, and retailers should undertake the responsibility of recycling/disposal of their own products.

5. Manufacturers of computer monitors, television sets and other electronic devices containing hazardous materials must be responsible for educating consumers and the general public regarding the potential threat to public health and the environment posed by their products. At minimum, all computer monitors, television sets and other electronic devices containing hazardous materials must be clearly labeled to identify environmental hazards and proper materials management.

#### *Responsibilities of the Citizen*

Waste prevention is perhaps more preferred to any other waste management option including recycling. Donating electronics for reuse extends the lives of valuable products and keeps them out of the waste management system for a

longer time. But care should be taken while donating such items i.e. the items should be in working condition.

Reuse, in addition to being an environmentally preferable alternative, also benefits society. By donating used electronics, schools, non-profit organizations, and lower-income families can afford to use equipment that they otherwise could not afford.

E-wastes should never be disposed with garbage and other household wastes. This should be segregated at the site and sold or donated to various organizations.

latest versions rather than buying new equipments.

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**Abstract:**

Agricultural marketing plays an important role not only in stimulating production and consumption but in accelerating the pace of economic development. Its dynamic functions are of primary importance in promoting economic development.

India's age-old farming practices have taken a turn in recent decades. There has been a technological breakthrough the evolution of high yielding variety seeds, increasing use of fertilizers, insecticides, and pesticides. The technological breakthrough has led to a substantial increase in production on the farms and to the larger marketable and marketed surplus.

The increase in agricultural production calls for a simultaneous improvement in the marketing system. The agricultural sector today is facing serious threats and challenges. For the country predominantly dependent upon agriculture the efficient agricultural marketing system is very essential and vital.

**Introduction:**

Marketing is as critical to better performance in agricultural as farming itself. Therefore, market reform and marketing system improvement ought to be an integral part of policy and strategy for agricultural development. Although a considerable progress has been achieved in technological improvements in agricultural by the use of high-yielding variety seeds and chemical fertilisers and by the adoption of plant protection measures, the rate of growth in farming in developing countries has not attended the expected levels. This has been largely attributed to the fact that not enough attention has been devoted to the facilities and services which must be available to farmers if agriculture is to develop.

A study of the agricultural marketing system is necessary



for an understanding of the complexities involved and the identification of bottlenecks with a view to providing efficient services in the transfer of farm products and inputs from producers to consumers. An efficient marketing system minimizes costs and benefits all the sections of the society.

### **Concept of Agricultural Marketing:**

The word agriculture indicate ploughing a field, planting seed, harvesting a crop, milking cows, or feeding livestock. Until recently, this was a fairly accurate picture. But today's agriculture is radically different. Agriculture has evolved in to agribusiness and has become a vast and complex system that reaches far beyond the farm to include all those who are involved in bringing food and fiber to consumers.

Agribusiness include not only those that are from the land but also the people and firms that provide the inputs (for ex. Seed, chemicals, credit etc.), process the output (for ex. Milk, grain, meat etc.), manufacture the food products (for ex. ice cream, bread, breakfast cereals etc.), and transport and sell the food products to consumers (for ex. restaurants, supermarkets). Agribusiness system has undergone a rapid transformation as new industry have evolve and traditional farming operations have grown larger and more specialized. The transformation did not happen overnight, but came slowly as a response to a variety of forces.

The term agricultural marketing is composed of two words -agriculture and marketing. Agriculture, in the broadest sense means activities aimed at the use of natural resources for human welfare, and marketing connotes a series of activities involved in moving the goods from the point of production to the point of consumption. Specification, the subject of agricultural marketing includes marketing functions, agencies, channels, efficiency and cost, price spread and market integration, producer's surplus etc.

Agricultural marketing system in developing countries including India can be understood to compose of two major sub-systems i.e. product marketing and input/factor marketing. The actors in the product marketing sub-system include farmers, village/primary traders, wholesalers, processors, importers, exporters, marketing cooperatives, regulated market committees and retailers. The input sub-system includes input manufacturers, distributors, related associations, importers, exporters and others who make available various farm production inputs to the farmers.

### **Agricultural Marketing in India:**

Since independence in India, agricultural marketing is characterized by pervasive government intervention. This intervention took place for various purposes in various forms. With the passage of time the need for

agricultural marketing also changed. In the initial period, marketing for agriculture was required to increase productivity, provide a market for agriproducts, arrangement for agricultural credit, etc. But in the present scenario, agricultural marketing is needed to enhance the efficiency of the producers to market their agriculture produce so that they can get good market margin. It also helps in eliminating or rather minimising the role of middlemen. Agriculture production system in India is characterised by small scale production and seasonality of production and demand.

### **Challenges Of Agricultural Marketing in India:**

1. **Licensing Barriers:** The compulsory requirement of owning a shop/go down for licensing of commission agents/traders in the regulated markets has led to the monopoly of these licensed traders acting as a higher entry barrier in existing APMCs for new entrepreneurs thus preventing competitions.
2. **Lack of Market Infrastructure in Agriculture Market:** Studies indicate that covered and open auction platform exists only in two-thirds of the regulated markets, while only one-fourth of markets have common drying yards. Cold storages units exist in less than one tenth of the market and grading Facilities in than one third of the markets. Electronic weigh-bridge is available only in a few markets
3. **Long Gestation Period of Infrastructure:** Projects and seasonality of agriculture produce agriculture marketing project have a long gestation period. The seasonality and aggregation of small surplus of agricultural produce further affect the economic viability of the projects, which deters investments.
4. **Lack of National Integrated Markets:** Under the present system, the marketable surplus of one area moves out to consumption centers through a network of middleman and traders, multiple market area and institutional agencies.
5. **Less former's Price Realization:** The share of farmers in consumer's price is very low particularly in perishables to a number of intermediaries, lack of infrastructure and poor holding capacity.
6. **Large Number of Marketing Channels with Long Supply Chain:** Traditionally the normal agriculture marketing in the country is fairly long with a large number of intermediaries between the producers and consumers, adding up more of costs without adding significant value

### **Problems Of Agricultural Marketing in India:**

1. **Small and scattered holding:** Farmers having small and scattered holdings are found in Indian agricultural system. Thus, the cost of producing and transporting agricultural produce increases and the marketing margin decreases.
2. **Lack of warehousing and storage facilities (cold storage or otherwise):** Farmers have to sell out their produce as soon as it is ready because there is a lack of adequate number of warehousing and storage facilities in India. It results in getting poor prices by the farmers. Most of the existing storage facilities are having very poor quality (are in very poor condition) which also affects the quality of the agricultural produce.
3. **Lack of transportation facilities:** Agricultural sector is affected mostly by lack of transport facilities which includes all weather roads, appropriate transport vehicles for transporting perishable goods and lack of linkage roads to mandis. Due to this, a chunk of money is expended over transportation costs.
4. **Lack of Agricultural Credit facilities:** Lack of availability of cheap credit facility and high dependence on informal credit channel has affected the expansion and modernisation of agricultural productivity. Due to rigid norms of banking sector, farmers are forced to borrow money from moneylenders at a very high rate of interest. They use to sell their produce at the earliest to repay the amount taken from moneylenders to avoid heavy interest charge.
5. **Lack of Uniformity in Grading and Standardisation:** Lack of proper grading facilities and standardised measures for categorisation of agricultural produce at the farmers' level results in weak bargaining power and sale of produce at the lower price.
6. **Poor Handling, Packing, Packaging, and Processing Facilities:** Lack of proper instruments for handling and processing and lack of scientific techniques for packaging of agricultural produce result in heavy wastage and loss to the farmers. Poor handling and packaging expose the product to substantial physical damage and quality deterioration.
7. **Lack of market information:** Generally, in rural areas there is unavailability of proper infrastructure. Many villages are still out of the reach of Information and Communication Technology. Due to this, farmers are unaware of the present and future prices of their produces prevailing in big markets. Thus, they have to accept any price for their produce offered by middlemen.

8. Presence of large number of middlemen: Due to lack of proper transportation, warehousing and infrastructural facilities farmers are forced to sell their produce at the point of origin. This widens the scope of middlemen as farmers are not directly connected to consumers. These middlemen charge abrupt high prices of these agricultural produce from the customers and also resort to malpractices like hoarding and black-marketing.

9. Lack of Farmers' Organisation: In India, the farmers are in scattered form and they use to sell their produces individually. This results in distribution of small amount of agricultural produces with high cost of transportation. Along with this, farmers have not any authorised body to guide and protect their businesses. On the other hand, traders are in organised form which enables them more powerful to bargain over prices. Under such situations, farmers will be generally exploited and do not get remunerative prices for their produce.

10. Inadequate Research on Marketing: All the efforts of the government are directed towards maximising the agricultural production but less emphasis has been given on the conduction of new researches for developing new marketing, storage, warehousing and preservation techniques. There is also need for

research on consumer demands and preferences, handling and packaging.

### **Role Of Government For The Upliftment Of Agricultural Sector:**

The Department of Agriculture and Cooperation and the Ministry of Agriculture have been renamed as the Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW) and the Ministry of Agriculture and Farmers Welfare respectively. With a view to focus on the issues of farmers welfare, the DAC&FW has created a separate Division called 'Farmers Welfare' under the charge of a senior officer. The Government believes, that farmers' welfare will improve if there is increase in net income from the farms. With this end in view, the approach is to reduce cost of cultivation, enable higher yield per unit and realize remunerative prices. Some of the important new initiatives in this context are:

1. Soil Health Card (SHC) scheme by which the farmers can know the exact nutrient level available in their soils which will ensure judicious use of fertilizer application and save money. The balanced use of fertilizer will also enhance productivity and ensure higher returns to the farmers.
2. Neem Coated Urea is being promoted to regulate use urea, enhance its availability to the crop and cut on cost. The entire

- quantity of domestically manufactured is now neem coated.
3. Paramparagat Krishi Vikas Yojana (PKVY) is being implemented with a view to promoting organic farming in the country. This will improve soil health and organic matter content and increase net income of the farmer so as to realize premium prices.
  4. The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is another innovative scheme to expand cultivated area with assured irrigation, reduce wastage of water and improve water use efficiency.
  5. In order to promote reforms of the agricultural marketing sector and to provide a common electronic platform deployable in selected regulated markets across the country, national scheme called 'National Agriculture Market' (NAM) has been introduced.
  6. The proposed new National Crop Insurance Scheme will protect the interest of farmers with a broader coverage towards crop losses and other such natural calamities. This is an intervention to cover the risks involved in farming.
  7. The State Governments are primarily responsible for development of the agriculture sector. However, the Government of India supplements the efforts of the States through appropriate policy measures and budgetary support. Various programmes/schemes/missions for the development of agriculture sector are being implemented in a decentralized manner with flexibility to State Governments to formulate and implement appropriate projects to suit their specific requirements. Some of the important schemes/programmes implemented as Centrally Sponsored Schemes are National Food Security Mission (NFSM); Mission for Integrated Development of Horticulture (MIDH); National Mission on Oilseeds & Oil Palm (NMOOP); National Mission for Sustainable Agriculture (NMSA); National Mission on Agricultural Extension & Technology (NMAET); National Crop Insurance Programme (NCIP); Unified National Agriculture Markets; and Rashtriya Krishi Vikas Yojana (RKVY).
  8. Other measures taken for the benefit of the farmers include enhancement in the Minimum Support Prices (MSP) to eliminate distress sale of agricultural produce by farmers, support to the farmers from time to time like debt waiver/relief, interest subvention on crop loans, revival package for strengthening Short Term Rural Cooperative Credit Structure, etc

**Suggestions For Improvements**

The Government of India have taken several steps to uplift the status of agricultural sector. But all these efforts are insufficient for the development of this sector. Here, few suggestions have been given for the improvement in agricultural marketing. These are:

1. **More investment in Market Research and Surveys:** To make the agricultural marketing more effective it is required to conduct marketing research in the field of agriculture on regular basis. This involves huge amount to conduct marketing research to get the real and effective solutions for agricultural problems. For this, the government should allocate sufficient amount for marketing research and survey.
2. **Dissemination of marketing information:** The government has made various efforts to provide marketing information to the farmers relating to market trends, market price, consumer behaviour, technical equipments, etc. This information should be provided to the farmers in time so that they can use this information for improving their performance in agricultural marketing.
3. **Establishment of regulated market:** The govt. of India has established number of regulated markets in all over India. But it is insufficient to serve large number of population of the country. Table 1 shows that total number of regulated market has declined as it was 7157 in the year 2010 which came down to 7114 in the year 2014. Along with this, population served by each regulated market also slashed down during same period. It is suggested that government should establish more regulated market in the country.
4. **Storage and warehousing facilities:** The government should extent and construct additional storage and warehousing facilities and improve their features to improve and retain the qualities of agricultural produce of the farmers. The government should provide loan facilities to the farmers for storage facilities.
5. **Improvement and extension of transportation facilities:** It is suggested that the government should make investment for the improvement and extension of roads and transportation facilities for connecting the villages with mandis. This will help the farmers to sell their produce to the customers directly, i.e. without taking the services of number of intermediaries.
6. **More easy norms for credit facilities:** The banks are providing credit facilities to the farmers but it is insufficient for completing their requirements. Marginal and small farmers are facing los of problems for getting credit

facilities. For this, the government should make adequate arrangements for providing loans to the farmers on more easy norms.

7. Agricultural price policy: The government decide the Minimum Support Price (MSP) for various agricultural commodities. It is a form of market intervention by the Government of India to ensure agricultural producers against any sharp fall in farm prices. It is suggested that more agricultural products should be taken under this pricing policy.

### **Conclusion:**

In India farmers are facing lots of problems whether it would be created by nature or by manmade. It will take much time to solve their problems. Every year in budget, government sanctions huge funds and formulates various policies and programs for the purpose of developing agriculture sector in India.

Agriculture marketing in India has made notable progress since independence but many challenges still remain. A dynamic and vibrant marketing system with adequate supply chain infrastructure has been felt necessary to keep pace with the changing agriculture production and growing market surplus. Moreover efforts should be made at all legal and policy levels to strengthen the rural economy and create rural

employment, which will surely augment production and productively leading to food security and inclusive growth of the country. There is also increasing pressure an agriculture produce economy to respond to the challenges and opportunities that the global markets pose in the era of globalization and liberalization.

In order to avoid isolation of small-scale farmers from the benefits of agricultural produce they need to be integrated and informed with the market knowledge like fluctuations, demand and supply concepts which are the core of economy. Marketing of agriculture can be made effective if it is looked from the collective and integrative efforts from various quarters by addressing to farmers, middlemen, researchers and administrators. It is high time we brought out significant strategies in agricultural marketing with innovative and creative approaches to bring fruits of labour to the farmers.

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## ***Impact on employee's productivity with regular training and development activity.***

**Dr. Jayashri Mundewadikar**

### **Abstract**

Training and development is the most common and prominent word referred in Human Resources. In today's competitive world, society has been looking forward for a better future world with respect to their current standards. To make this happen every individual and society has been working in accordance to their vision, through different channels. When we talk about society it refers to millions of individuals, thousands of corporates, different societies which for sure differ in their vision but the cause is same of better world.

In this research paper we are going to Gauge the impact on an employee's work life with respect to regular training and development. Provided by his employer for achieving the common vision of the organization. Training is a tool that helps both organization and employees in stepping up the skill sets with development of both. Qualitative and quantitative roles at different organizational levels and also keeping intact the balanced work life.

**Key words:** Employee Training, Employee Development, employee Productivity

### **Introduction:**

Training and development has been defined in many ways with different meaning and requirements. Hence, the training and development pattern cannot be universal and it changes in accordance with requirement and achievement of Goal. For instance, training pattern which has been successful with a company "A", is not necessarily important that the same training pattern will bring the required results in company "B". So, to manage an organization in effective and to get the required out come from the employees it's always importance to customize the training and development process in accordance to the employee's and their respective roles.

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*Impact on employee's productivity with regular training and development activity.*

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As organizations try to survive in the turbulent dynamic market, strong emphasis must be laid on human capital in order to be competitive and financially solvent.

To make this happen organizations should have employees that have capability of adjusting to swift dynamic business environment. Paradise, (2007) in his report stated that U.S. organizations alone spend more than \$126 billion annually on employee training and development hence it is very essential at all employee levels, due to the reason that skills erode and become obsolete over a period.

## **Literature Review**

### *Training And Development:*

According to the Edwin B Flippo, "Training is the act of increasing knowledge and skills of an employee for doing a particular job." The term 'training' indicates the process involved in improving the aptitudes, skills and abilities of the employees to perform specific jobs. Training helps in updating old talents and developing new ones. 'Successful candidates placed on the jobs need training to perform their duties effectively'. Objectives of training: Training activity is done in any organisation to have skilled and willing workforce when required.

It have other objectives too like :- Individual Objectives – Personal objectives of employee can be achieved by enhancing the individual contribution to the organization with help of training. Organizational

Objective: - Individual effectiveness can be enhanced.

### **Hypothesis:**

*H1: Regular Training and development activities is one of the best practices to enhance employee's performance in the organisation.*

### *II. Employee Training:*

Training in organizations is viewed as a systematic approach to enhance the skill of existing and new employees to achieve a common purpose of organization and also it acts as an intervention to meliorate organization's goods and services quality in stiff competitive environment.

A quote by Narayan Murthy Infosys "Investment in training is a huge necessity for knowledge-based corporations"

### *iii. Employee Development:*

Development refers to activities leading to the acquisition of new knowledge or skills for purposes of growing. Organizations provide employees with development programs in order to enhance their capabilities. There's a quote which states "All development begins with the identification of a problem" Thus organizations need to invest in continuous employee development in order to maintain employees as well as the organization success

### *iv. Employee Productivity:*

When correctly implemented, Training and development start

working as catalyst on improving the individually performance and in turn achieving the organization's overall vision. It has also been observed that there has been reduction in considerable amount of Stress among the employees who have been benefited with training and development programs.

### **Conclusion:**

The robust growth of the corporates which have been competing for century is due to timely training and development initiative taken to enhance the employee skill sets.

### **Suggestions:**

As earlier said, "All development begins with the identification of a problem", more emphasis should be given on identifying the basic problem. Any good amount of training and development which is not correlated to the problem will

never help an organization in achieving the Goal. Hence, problem analyzing should also be considered as integral evaluation base for Training and development.

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**Abstract**

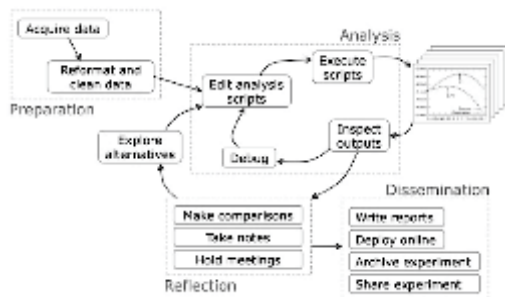
Data Science is a study which deals with identification, representation and extraction of meaningful information from data sources to be used for business purposes. With enormous amount of facts generating each minute, the requirement to extract the useful insights is a must for the businesses to stand out from the crowd. Data engineers setup the database and data storage in order to facilitate the process of data mining, data mugging and other processes. Every other organization is running behind profits, but the companies that formulate efficient strategies based on fresh and useful insights always win the game in the long-run. Data Science refers to an emerging area of work concerned with the collection, preparation, analysis, visualization, management, and preservation of large collections of information. Although the name Data Science seems to connect most strongly with areas such as databases and computer science, many different kinds of skills including non-mathematical skills are also needed here. Data Science is much more than simply analyzing data. There are many people who enjoy analyzing data who could happily spend all day looking at histograms and averages, but for those who prefer other activities, data science offers a range of roles and requires a range of skills. Data science includes data analysis as an important component of the skill set required for many jobs in the area, but is not the only skill. Data scientists play active roles in the design and implementation work of four related areas such as data architecture, data acquisition, data analysis and data archiving. In the present paper the authors will try to explore the different issues, implementation and challenges in area called Data science.

**Introduction**

Data Science is the extraction of learning from substantial volumes of information that are unorganized or unstructured, which is a continuation of the field of

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information mining and Perceptive investigation, otherwise called information disclosure and information mining. "Unstructured data" can incorporate messages, features, photographs, online networking, and other client produced substance. Information science frequently obliges dealing with an awesome measure of data and composing calculations to concentrate bits of knowledge from this information. The basic flow control in a data science process can be summed up in the following diagram :



### Basic Steps in Data Science:

The three segments included in data science are arranging, bundling and conveying information (the ABC of information). However bundling is an integral part of data wrangling, which includes collection and sorting of data. However what isolates data science from other existing disciplines is that they additionally need to have a nonstop consciousness of What, How, Who and Why. A data science researcher needs to realize what will be the yield of the data science transform and have an unmistakable vision of this

yield. A data science researcher needs to have a plainly characterized arrangement on in what manner this yield will be accomplished inside of the limitations of accessible assets and time. A data scientist needs to profoundly comprehend who the individuals are that will be included in making the yield. The steps of data science are mainly: collection and preparation of the data, alternating between running the analysis and reflection to interpret the outputs, and finally Dissemination of results in the form of written reports and/or executable code. The following are the basic steps involved in data science :

#### a) Data wrangling and mugging :

Collecting data from relevant areas and the process of manually converting or mapping data from one "raw" form into another format that allows for more convenient consumption and manipulation of the data with the help of semi-automated tools is referred to as data wrangling or munging. Sorting out data includes the physical stockpiling and arrangement of information and joined best practices in information administration. It basically includes moving individuals and frameworks from current to new and from learner to master. Propelling advances and abilities is the pith of development. Bundling data is the next step that follows arranging data. Bundling data includes consistently controlling and joining the fundamental crude information into another representation and bundle. Bundling data is actually the opposite of sorting

out data and includes moving individuals and frameworks from new to current and from master to apprentice. This is the specialty of making things basic yet not less complex.

**b) Data Analysis :** Analysis or investigation of data is a procedure of assessing, changing, and demonstrating information with the objective of finding helpful data, recommending conclusions, and supporting decision-making. The data is processed using various algorithms of statistics and machine learning to extract meaning and useful conclusions from the large volumes of data.

**c) Convey Data :** Conveying data includes methods to transform the mathematical or statistical conclusions drawn from the data into a form that can be easily understood and interpreted by those in need of it. Conveying data is empowering the development starting with one perspective then onto the next, empowering a beginner to turn into an expert, current technology to appear to be new and allowing the modeled information to be seen by apprentices and making new technology to appear like it was an integral part of the system.

### How Data Science is different from Big Data?

Though data science almost sounds similar to the concept of Big Data, but actually there is a huge difference between these two terms:

#### Big Data

Consists of voluminous amounts of unstructured, semi-structured or structured data  
Used to extract meaningful insights from large data sets.

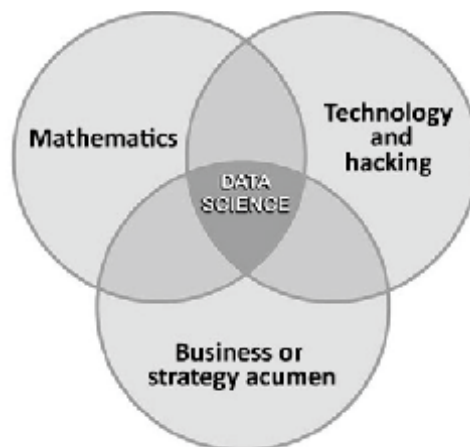
#### Data Science

Combines statistical, mathematical, programming and problem-solving techniques.  
Application of above mentioned techniques for better strategic decision-making.

- Nowadays the kind of raw data has become more heterogeneous and voluminous than ever before which cannot be accommodated on a single computer
- All the analog information is being converted into digital ones to grab maximum insights possible from them
- One of the concepts that deal with this irregular and unorganized data is the domain of data science.

### Required Data Science Skills

It is a field which requires a specific skill set comprising of expertise in following:



**Mathematics** – In order to understand a complex web of unstructured data requires a combination of heuristics and quantitative analysis to provide solutions to the prevailing problems. Many a times the business problems require analytical models to be

prepared in order to resolve them and knowledge of data analysis is a must. Nowadays advanced analytics tools like SAS are being extensively deployed for getting increased insights. However there is a misconception among people about data science that it is purely related to statistics. But it is not true as statistics is one of the pillars that support data science.

**Technology and hacking** – A data scientist is supposed to have a solid technical knowledge about breaking up and solving problems by creating complex and solvable Data Science algorithms. Data science requires the expert to think like a data analyst through the high-dimensional data and data control flows.

Here by stating Hacking, should not be taken as literal hacking the computers and unethical intrusions. But, the reference is about bringing creativity and innovation into the process in order to come up with unique techniques to solve the existing problems.

**Business or strategy acumen** – One of the important pillars of data science is business or strategic insights. Along with an expertise in mathematics and technological skills, a clever and deep insight in business is also required to become a complete package for data scientist's job. A sharp vision that could predict the future trend and prepare the strategy to deal with it beforehand is what companies want now a days to survive in this cut-throat

competition. Hence you can say that data science is a perfect amalgamation of technological and strategic proficiency which is a must to align the business requirements with tactical knowledge.

### Data Science Scope



- Despite struggling through the late adoptions and resistance in implementation, data science has managed to grow tremendously over past years, i.e., 2011-2016.
- The concept of data science is being widely accepted across the globe, especially in the developing countries like India, Nigeria, China, etc.
- More and more industries are hiring data scientists in the countries at an increasing rate like Singapore at 91%, Nigeria at 84%, United States at 71% and Hong Kong at 55% per se.

A study by IBM's Business Tech Trend says "Nearly 70% of leading companies say analytics are integral to how their organizations make decisions."

### Why should we use Data Science?

What made data science to gain huge popularity in such a short span of

time, Let's have a look into it:

**Accurate answers** – Business strategies are better formulated when these are backed by accurate predictions and logic which is possible only through data science algorithms. A growing number of companies have realized the applications of data science and are investing in implementing this concept to serve their customers in a better way.

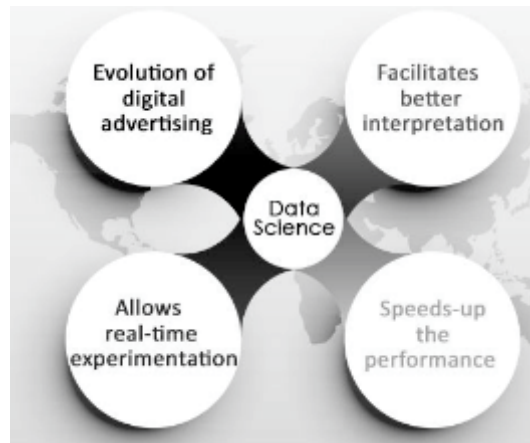
**Better decision-making ability** – According to a study conducted by Harvard Business Review revealed that the companies which are data-driven perform better in objective financial and operational measurements. Moreover these companies earned 6% more profit than their rivals.

**Finds important business trends** – Big Data scientists look into the data, find out the pattern and forecast on the basis of specific trends way before it is visible to the other subject matter experts. Going forward towards fulfilling the organizational goals, data science taps into the existing information and finds out significant trends for which the organization needs to be prepared with alternative strategies. Acting as a competitive advantage, it is beneficial to a great extent for the industry players in standing out from the rat race.

### Why do we need Data Science?

Every phenomenon has a reason behind its occurrence. So has data

science. Therefore it would be interesting to know the emerging trends that give data science the utmost importance to keep pace with the changing scenario:



**Evolution of digital advertising**– With the advent of digital advertisement, it has become essential for the companies to adopt data science techniques. And surprisingly, These data science algorithms are being implemented in many steps starting from display banners to digital billboards, which increase the CTR on the advertisements which was not possible for traditional advertisements.

**Facilitates better data interpretation**– Analyzing facts statistically allows the marketers to interpret it in a better way which ultimately simplifies formulating strategies. Data science applications help the companies target different segments more effectively.

**Speeds-up the performance**– The companies do not tend to make

moves based on anticipation anymore, but everything is preplanned and a properly strategized activity. Data Science plays a pivotal role in fulfilling this necessity as it provides sufficient insights that are required for planning and execution, helping in speeding up the process in effect.

### **Allows real-time experimentation-**

Data science facilitates the companies with the information about the tastes and preferences of the customers, which helps in understanding customers more deeply which allows companies to experiment in real-time rather than trying and testing back-stage.

### **8. Conclusion :**

The practice of data science can best be described as a combination of analytical engineering and exploration. The business presents a problem we would like to solve. Rarely is the business problem directly one of our basic data mining tasks. We decompose the problem into subtasks that we think we can solve, usually starting with existing tools. For some of these tasks we may

not know how well we can solve them, so we have to mine the data and conduct evaluation to see. Data science can definitely add value to business by the addition of statistics and insights across workflow. Data science can add value across all industries.

### **Acknowledgment**

The author is very much grateful to Suryadatta Group of Institutes for allowing & for giving all time encouragement to do research in area called Data science in the department

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**Abstract:**

The aim of Working capital management is to ensure that the firm is able to continue its operation and has sufficient cash flows to satisfy both maturing short term debt and upcoming operational expenses.

Stimulate sales by offering customer credit and ready goods for sale Minimize cost by balancing production and sales level through inventory Secure low cost financing. The firm's policies for managing its working capital should be designed to achieve three goals Adequate liquidity- if a firm locks sufficient cash to pay its bills when due it will experience continuing problems. The most important goals is to achieve adequate liquidity for the conduct of day to day operations Minimizations of the risks- in selecting its sources of financing payables and other short terms liabilities relatively low costs. The firm must ensure that these near obligations do not become excessive compared to the current assets and liabilities among current amount is a task of minimizing the risk of being unable to pay other obligations.

Contribute to maximizing firm's values-the firm holds Working capital for the same purpose as it holds any other assets that is to maximize the present value of common stock and value of firm. It should not hold idle current assets any more than it should have idle fixed assets. The investments of excess cash minimizing of inventories, speedy collection of receivables and elimination of unnecessary and costly short term financing or contribute maximizing the value or the firm.

**Keywords:** Working Capital Management, financing payables current assets fixed assets.

**Introduction:**

Working Capital is the key difference between the long terms financial management and short term financial management in terms of the timing of cash.

Long term finance involves the cash flow over the extended

period of time i.e. 5 to 15 years, while short term financial decisions involve cash flow within a year or within operating cycle. Working capital management is a short term financial management. Working capital management is concerned with the problems that arise in attempting to manage the current assets, the current liabilities & the Inter relationship that exists between them. The current assets refer to those assets which can be easily converted into cash in ordinary course of Business, without disrupting the operations of the firm. Working capital management entails short term decisions generally relating to the next one year period which are reversible. Working capital is also known as circulating capital or revolving capital.

#### Composition of working capital

##### *Major Current Assets*

- 1) Cash
- 2) Accounts Receivables
- 3) Inventory
- 4) Marketable Securities

##### *Major Current Liabilities*

- 1) Bank Overdraft
- 2) Outstanding Expenses
- 3) Accounts Payable
- 4) Bills Payable

The Goal of Capital Management is to manage the firms current assets & liabilities, so that the satisfactory level of working capital is maintained. If the firm cannot maintain the satisfactory level of working capital, it is likely to become insolvent & may be

forced into bankruptcy. To maintain the Margin of safety current asset should be large enough to cover its Current Assets.

Main theme of the theory of working capital management is interaction between the current assets & current liabilities.

#### **Literature review**

##### **Objective of Working Capital**

The important objective of working capital are as follows:

- I. To support satisfactorily, the investment in fixed assets and to ensure smooth functioning of business operations.
- II. To provide necessary outlay for investments, as well as provide liquidity to business.
- III. To help in contributing to the efficiency of operations in a company.
- IV. To help in controlling technical insolvency.
- V. To ensure the maintenance of creditworthiness with the outside world.
- VI. To represent a margin of safety to the short term creditors.
- VII. To help the firm to take advantage of purchase discounts and to face confidently the favorable changes in business operations
- VIII. To meet day-to-day cash transactions demand.
- IX. To finance accounts receivable and inventories.

To meet maturing obligations to the creditors and the other outsiders

### Importance of Working Capital:

Working capital may be regarded as the lifeblood of the business. Without insufficient working capital, any business organization cannot run smoothly or successfully.

In the business the Working capital is comparable to the blood of the human body. Therefore the study of working capital is of major importance to the internal and external analysis because of its close relationship with the current day to day operations of a business. The inadequacy or mismanagement of working capital is the leading cause of business failures.

To meet the current requirements of a business enterprise such as the purchases of services, raw materials etc. working capital is essential. It is also pointed out that working capital is nothing but one segment of the capital structure of a business.

In short, the cash and credit in the business, is comparable to the blood in the human body like finance s life and strength i.e. profit of solvency to the business enterprise. Financial management is called upon to maintain always the right cash balance so that flow of fund is maintained at a desirable speed not allowing slow down. Thus enterprise can have a balance between liquidity and profitability. Therefore the management of working capital is essential in each and every activity.

### Need for Working Capital:

Working capital is needed for following purpose:

- For the purpose of raw material components and spares
- To pay wages and salaries
- To ensure day to day expenses and overload costs such as office expenses. Working capital is needed by the business to:
  - 1 Pay supplies and other creditors
  - 2 Pay employees
  - 3 Pay for stock
- To meet selling costs as packing, advertising etc.
- To provide credit facilities to the customers.
- To maintain the raw material, work in progress, stores and spares and finished goods.
- The object of any business is to earn profit. The main factor affecting the profit is the magnitude of sales of the business. But the sales cannot be converted into cash immediately. There is a time lag between the sales of goods and realization of cash there is a need of Working capital in the form of current assets and to fill up this time lag. Technically this is called operating cycle or Working capital cycle.

### Types Of Working Capital:



**Gross Working Capital:** Gross Working capital refers to the amount which the company has invested into

the current assets; current assets includes cash, stock, debtors, or anything which can be converted into cash immediately.

**Net Working Capital:** Net Working capital refers to the difference between the current assets and current liabilities. Current liabilities include trade creditors, bills payable, outstanding expenses or any debt which company has to pay within a year.

**Net working capital = current assets - current liabilities**

**Permanent working Capital:** Permanent working capital is the minimum amount of current assets which is needed to conduct a business even during the dullest season of the year. It is the amount of funds required to produce the goods and services which are necessary to satisfy demand at a particular point. It represents the current assets which are requiring in a continuous basis over the entire year.

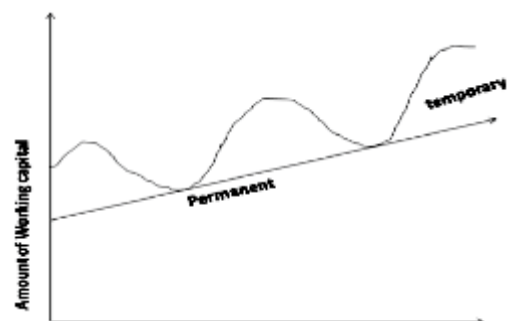
**Temporary Working Capital:** It represents the additional assets which are required at different times during the operating year- additional inventory, extra cash et. It is temporarily invested in current assets. It is particularly suited to business of a seasonal or cyclical nature.

**Balance Sheet Working Capital:** The Balance sheet working capital is one which is calculated from the items appearing in the profit and loss

account. It shows the real flow of money or value at a particular time.

**Negative Working Capital:** Negative working capital emerges when current liabilities exceeds current assets.

The following diagram shows permanent and temporary working capital:



Both kinds of working capital i.e. permanent and temporary are necessary to facilitate production and sales through the operating cycle.

**Working Capital Cycle:**

Working capital cycle or Operating cycle or cash cycle is the time duration for conversion of cash into cash equivalents like raw materials, work in progress, finished goods,

sundry debtors and their after back into cash



If the company has a certain amount of cash, it will required for purchasing the raw material though some raw material may be available on credit basis. The company has to spend some amount of labor and factory overheads to convert the raw material in work in progress, and ultimately finished goods. These finished goods when sold on credit basis get converted in the form of sundry debtors. Sundry debtors are converted into cash only After the expire of credit period, thus there is a cycle in which the originally available cash is converted in the form of cash again but only after following the stages of raw material, work in progress, finished goods, and sundry debtors. Thus, there is a time gap for the original cash to get converted in the form of cash again. Working capital needs of the company arise to cover the requirement of funds during this time gaps, and the quantum of working capital needs varies as per the length of this time gap. Thus, some amount of funds is

blocked in raw materials, work in progress, finished goods, and sundry debtors and day to day cash requirement. However, some parts of these current assets may be financed by the current liabilities also. E.g. .some raw materials may be available on credit basis, all the expenses need not be paid immediately, workers are also to be paid periodically etc. but still the amount required to be invested in these current assets are always higher than the funds available from the current liabilities. This is the precise reason why the needs for working capital arise.

A long cycle indicates overstocking of inventories or delayed collection of receivables and is considered unsatisfactory.

Using the operating cycle, the working capital turnover can also be computed as  $365 / \text{working capital cycle}$ . A high turnover ratio indicates a better position.

IF YOU	THEN
Collect Receivables (Debtors) faster.	You release cash from cycle.
Collect Receivables (Debtors) slower.	Your receivables soak up cash.
Get better credit (in terms of duration or amount) from suppliers.	You increase your cash resource.
Shift inventory (stock) faster.	You free up cash.
Move inventory (stock) slower.	You consume more cash.

**Factors Affecting the Composition of Working Capital:**

There are no set rules or formula to determine the working capital requirement of firms. A large number of factors, each having a different importance, influence working

capital needs of firms. Also, the importance of factors changes for a firm over time. Therefore, an analysis of relevant factors should be made in order to determine total investment in working capital. The following is the description of factors which generally influence the working capital requirements of firms.

*Nature of raw material used:*

The Nature of raw material used in the manufacturing of finished goods greatly influences the quantum of raw material inventory. E g, if raw material is an agricultural product whose availability is seasonal in character, the proportional of raw material inventory to finished goods inventory will be quite high.

Similarly companies using imported raw material with long lead time tend to have a high proportion of raw material inventory. In the case of capital goods manufacturing companies the demand for whose product is growing over time, the tendency will be to have high inventory of raw material and components.

*Process technology used:*

In case of raw material has to go through several stages during the process of production, the work in progress inventory is likely to be much higher than any other item of the current assets thereby increasing the need of working capital.

*Nature of finished goods:*

The Nature of finished goods greatly affects the amount of finished goods inventory. E g, if the finished goods

have a short span of shelf life as in case of cigarettes, the finished goods inventory will constitute a very low percentage of current assets.

In case of companies the demand for whose finished goods is seasonal In nature, as in case of fans, the inventory of finished goods will constitute a high percentage of total current assets. This is mainly because from the point of view of the fixed cost to be incurred by the company it would be more economically to maintain an optimum level of production operations during the busy seasons.

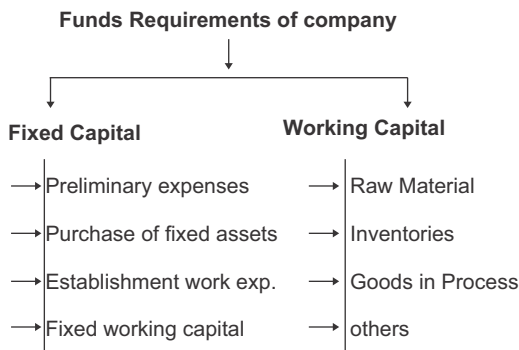
*Degree of competition in the market:*

When the degree of competition in the market for finished goods in an industry is high, then companies belonging to this industry may has to resort to an increased credit period to its customers, partially lowering credit standards and similar other practices to push their products. These practices are likely to result in a high proportion for account receivables thereby increasing the need for working capital.

*Growth and expansion:*

As the company grows, it is logical to except that a larger amount of working capital is required, it is, of course, difficult to determine precisely the relationship between the growth in volume of business of a company and the increase in the working capital. The composition of working capital also shifts with economic circumstances and corporate practices. Other thing being equal, growth industries

require more working capital than those are static. The critical fact however, is that the need for increased working capital funds does not follow the growth in business activities but precedes it. Advance planning of working capital, is therefore a continuing for a growing concern.



Every company requires funds for investing in two types of capital i.e. fixed capital, which requires long-term funds, and working capital, which requires short-term funds.

### **Sources of Financing Working Capital:**

Current assets are those assets, which unlike fixed assets change their forms rapidly. Due to this, they need to be financed through short-term funds. Short term funds are called the current liabilities.

The following are the major sources of raising short term funds:

#### *Suppliers credit:*

At times, business gets raw material on credit from suppliers. The cost of

the raw material is paid after some time, i.e. upon completion of the credit period. Thus, without having an outflow of cash the business is in a position to use raw material and continue the activities. The credit given by the supplier's of raw material is for a short period and is considered current liabilities. These funds should be used for creating current assets like stock of raw material, work-in-progress, finished goods etc.

#### *Bank loan:*

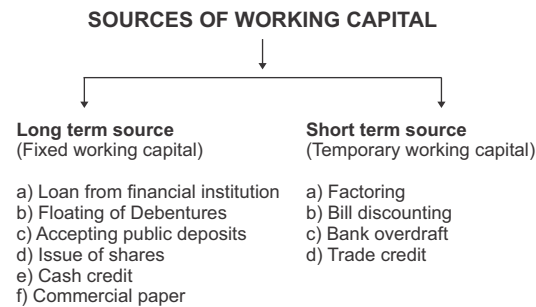
This is a major source for raising short term funds. Banks extend loans to businesses to help them create necessary current assets so as to achieve the required business level. The loans are available for creating the following current assets:

- Stock of raw materials
- Stock of work-in-progress
- Stock of finished foods
- Debtors

Banks give short term loans against these assets, keeping some security margin. The advances given by banks against current assets are short-term in nature and banks have considered doing so. Thus bank give loans for creation of current assets are also current liabilities.

#### *Promoters fund:*

It is advisable to finance a portion of current assets from the promoter's fund. They are long term funds and therefore do not require immediate repayment. These funds increase the liquidity of the business.



Sources of additional working capital include the following:

- Existing cash reserves
- Profits (when you secure it as cash!)
- Payables (credit from suppliers)
- New equity or loans from shareholders
- Bank overdrafts or lines of credit
- Term loans

If you have insufficient working capital and try to increase sales, you can easily over-stretch the financial resources of the business. This is called overtrading. Early warning signs include:

- Pressure on existing cash.
- Exceptional cash generating activities e.g. offering high discounts for early cash payment.
- Bank overdraft exceeds authorized limit.
- Seeking greater overdrafts or lines of credit
- Part-paying suppliers or other creditors.
- Paying bills in cash to secure additional supplies.
- Management pre-occupation with surviving rather than managing.
- Frequent short-term emergency requests to the bank (to help pay Wages, pending receipt of a cheque).

## Research Methodology:

### Secondary Data:

This data available because they were collected for some other purpose. This may include existing company's information, data of other organization including govt. sources and syndicate data source such as consumer purchase panel.

There are many methods of secondary data collection and the main methods include:

- Books
- Records
- Biographies
- Newspapers
- Internet

In my research the secondary data was collected through following ways:

- Annual Reports of the company.
- Office manuals of the department.
- Magazines, Reports in the company.
- Policy documents of various departments.

Data Range - 5 years

Data Analysis tool-

- ✓ Ratios
- ✓ Percentage
- ✓ Charts
- ✓ Trends

### Objective of the study:

Every study emerges to achieve certain objectives. The main objective of carrying out this objective is to know and gain practical knowledge and to know the organizational working culture.



Following are the objective to carry out this project-

- To study the working capital requirement of the firm.
- To study how well a firm can meets its ongoing cash obligations.
- To study the efficiency of company to meet its current liabilities.

### **Findings:**

- In the gross working capital of the firm, a major part is occupied by sundry debtors, cash in hand and cash at bank.
- The standard current ratio to be maintained by the company is 2:1; the company exceeds minimum current ratio all the years.
- The quick asset ratio minimally maintained by the company is 1:1, the company was not able to maintain this ratio, its liquid ratio was very high then required.
- The company is able to maintain sufficient amount of working capital at all the years.
- The debtor's collection period has been continuously decreasing, which is a good sign for the company.

The creditor's payment period was very high in 2011-12, but due to company's great effort the payment period decreased for next two years.

### **Conclusion:**

The main objective of research was to study the working capital analysis of the company. Working capital of the company is of increasing nature and it increased in line with increased in

turnover of the company. Working capital turnover ratio of the company is at satisfactory level.

The net working capital of the firm is satisfactory in each year, which indicates the Shrinath Engineering, has sufficient net working to meet the claim of creditors and day-to-day needs of the business.

In this project research the organization is doing well as per the sale and gross profit is concerned and net profit of the company has increased in year 2013-14. The debtors are collected earlier and it results in increasing in cash and due to early collection of debtors the company is able to pay the creditors in time.

### **Suggestions:**

- It can be said that overall financial position of the company is normal but it is required to be improved from the point of view of profitability.
- The current ratio is very high (2.32), thus the company is suggested to decrease its current assets.
- The company's huge amount is blocked in sundry debtors, so the company is suggested to decrease its debtors.
- The company is suggested not to over increase working capital turnover ratio.
- The company is suggested to decrease its direct and indirect expenses.

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