Change, Culture And The Future

Change is essential to the short and long term vitality of the organization. However, change is generally resisted by persons—not limited to any one level or group. The concept of change is generally not well understood, and thus, many have difficulty with change. Functioning within the change-oriented environment and organization requires understanding change and the change process. Basic characteristics of change are:

1. Technology is driving the change, although it may manifest itself in various ways. When new process, systems or product starts, change is reality. We must learn to better plan and anticipate technological changes, at all levels.
2. Change, particularly technologically driven change, is either directly or indirectly related to competitive global forces. This means customer focus and demands are at the center of change, and we must better understand customer demands.
3. The sooner people impacted by change are involved, the more likely they will react positively to change. This means we must spend more time with customers, process and product, studying, analyzing, and understanding change forces.
4. People tend to resist change if they are not involved in change or implementation processes. If we wish people to support and feel good about change, involve them early and regularly, and show positive, expected, planned results from change.
5. Behaviors (i.e., attitudes) can be learned, and thus, training about change can be helpful in preparing for, and implementing, change. Change supported by information helps all better understand changing environments—this is cultural education.
6. Participatory change is more productive versus change by autocratic order. Do not only tell people what to do—help them understand in positive and supportive ways. This means participatory teams as implementers of change in the future.
7. People generally resist that which they do not understand—communication and education are major keys. This relates to trust—built through ongoing long-term relationships earned over time and destroyed quickly if change is mishandled.
8. Psychologically, it is extremely important to people that they feel like they are in control of their lives and destinies. Thus if change is mismanaged and people are left out, they will not only resist change, but this will likely become a potentially very counter-productive situation.

This is important since so much about becoming and remaining competitive relates to the need for change. We can only compete if we are changing constantly. This means becoming increasingly productive and improving quality, reflecting a shared vision through change.

It is only through change that world class, global behaviors, can be achieved. If we do not wish to participate in change, then a world view will likely be less achievable. This assumes a key part of the basis for a healthy world view is on-going improvement and building
and learning new systems for doing business, now and increasingly in the future. We will never be able to sit back and relax since the technological global marketplace is increasingly dynamic.

It is important to remember that this can not be true for only a few persons in the organization. We all must work as a team to achieve changes necessary for becoming and remaining competitive globally in the future. Persons that choose not to participate, for any reason, in the future, will simply be left out in the cold. We all must commit together, and undertake to grow together and at a reasonable and consistent pace--together. We will either be successful together, or fail together.

Within this environment, and consistent with change, information and communication among people, and trust among persons, are key factors. Virtually all problems and opportunities for improvement can be traced back to this. Whether on a large or small scale, if we are not communicating, verbally, in written and drawn form, and numerically and electronically, we will be less effective in our work--essentially operating in a vacuum. And without trust we will not be relied upon, team members will not depend upon us, and when we say things are going to be done no one will believe us. Trust and communication are vital to the change process.

Beyond the obvious, how do we know we are ready for change? What might be the indicators--what do we look for within our environment, to know that change is needed and warranted? It goes without saying that this will vary from organization to organization, depending on many variables, again many of them obvious--but many of them not so obvious--and certainly rather complex. Variables affecting this overall climate could include:

1. Nature of our product or service.
2. Number, types of employees (ie, technical, skilled).
3. Maturity and years in the business.
4. Maturity and experience of our employees.
5. Nature of the community we live and work in.
6. Nature and number of our customers and suppliers.
7. Nature of documentation about our organization.
8. How we are organized, on paper, and day-to-day.
9. The way we solve problems.
10. Overall level of education, formal and informal.
11. Discipline of people, individually and collectively.
12. How we communicate immediately, over time.
13. The ways we teach and learn.
14. Mission--what, how, when, why, who and so on?
15. Our technology and technical capacity.
16. Satisfaction of people, measured in many ways.
17. How we evaluate, individually and collectively.
18. How we handle differences of opinion.

While this list is not necessarily exhaustive, the climate for change touches all aspects of the organization. We must understand this to control the change for our benefit.

But how do we know if change is warranted--or if it is too much--or not enough? We must recognize that if we are not changing, we are likely standing still. And if we are standing still, the question is, is the competition standing still? We probably already know that the competition is not idling away--and so we have the answer. More change may be better than insufficient change, assuming the change is reasonably well managed, planned for, cost effective, communicated and implemented. Other questions about change include:

1. Are people excited to work in our organization?
2. Are we introducing and using new cutting edge technologies, routinely, in the organization?
3. How do we encourage, facilitate and evaluate new ideas, innovation and creativity--at all levels?
4. What broad technical and non-technical skills, attitudes, knowledges and systems are important, if not essential, for our continued existence?
5. How are we developing our leaders, at all levels, for the future, in our organization?
6. Are various persons or subgroups working in a vacuum, not fully participating and cooperating--pulling together toward common goals and objectives, helping to fulfill our mission?
7. Do people in our organization have a strong sense of shared responsibility and authority?
8. Do we have broad job descriptions to encourage moving into new areas of learning and challenges?
9. Are people able to work independently, unsupervised to a great extent, and on their own?
10. Can we make significant infrastructural changes to empower people at all levels?
11. How do we "listen" to our customers and suppliers, internal and external, for improvements--and how do we take action on this for everyone's best advantage, leading to ongoing improvements for competitive advantage in the marketplace?
12. What are systems for "benchmarking", both for individuals and the organization?
13. Have we organized our systems to facilitate real time decisions based on data, or do we make decisions sluggishly, at wrong levels without data?
14. How do we move information--from group to group--internal and external--to help assure its integrity and ongoing improvement?
15. Do we encourage all to see the "big picture"?
16. Are engineering, quality and production functions coming closer together, increasingly one?
17. Is marketing and sales changing to become a quality engineering representative function, carefully listening to the voice of the customer?
18. Have we structured our systems in such a way so as to seamlessly transfer the technology from one location to another—one culture to another?

While there are certainly other variables, issues and questions related to the climate for change and the emergence of world class, this captures key concerns. This should also provide a basis for questioning and introspection in management and leadership elements, as we attempt to wrestle with these types of issues.

**Education Infrastructure, World View**

Pivotal in the process of building infrastructure in organizations, while not easy, is education. Basic issues about change and the change process are based on and related to educating people, changing their attitudes, gaining "buy in" from various persons and levels over time. Educational systems must be built and led by individuals from within the organization, preferably at high levels. This requires:

1. **Ongoing improvement, as defined in virtually any manner within the organization, relies upon all people at all levels, to commit to personal educational ongoing improvement.** We must commit to growing--teaching and learning--to make lasting change essential to being world view (WV). The notion of "ongoing" must be taken very seriously. We must recognize that this approach, once started, should not, and will not be easily reversed or stopped.

2. **It is assumed that the kingpin element in the overall philosophy and approach, facilitating and driving the change process, is education.** We must commit to rearrange our organization in such a way that accommodates the need and desire by persons to teach and learn, growing the WV in the process. The premise is, excitement and energy which is necessary to sustain change over time, is the "revitalizing of the brains" which will occur as a function of people bringing their brains back to life through education and challenges to address opportunities for improvement.

3. **Change will require all of us, at all levels to be increasingly flexible, and to be open to doing things differently in the future--actually growing the system and infrastructure as we go forward.** This is referred to as the "stretch factor" and it is assumed to be an ongoing element in the WV approach--essential to being increasingly competitive in the future--and this applies to all persons within the "family" of our organization. The question is "how do we stretch ourselves and others, in positive and proactive ways, and with their full knowledge and participation?"
12. It is assumed that compliance with, and/or pursuit of, at least the Baldrige Award, ISO 9000, or other "standards" driven programs is, or has been, part of the agenda within your organization. It is further assumed that these are essentially good and solid (if not seemingly costly) pursuits which are appropriate for WV, but that they should be done within the broader framework of a customer driven approach which includes most of the necessary documentation, technical and communication elements and systems.

13. Evaluation systems in all that we do is assumed to need to be adjusted to accommodate changes in empowerment at other levels and in other ways throughout the organization. Individuals must have opportunities for advancement, all connected to accomplishing applications of the WV tools to solve technical problems for ongoing improvement through team work. The amount and type of tools they are studying and using should be a key part of the criterion for evaluation in the future.

14. Diversity in thought, values and behaviors, disconcerting as this can be at times, will be one of the keys to strengthening our world view in the future. How do we systemically teach our people, culturally, to be as open to culture diversity as possible, even to the extent that we have multiple languages being spoken and used in the workplace? The multi-faceted value and ethnic sets which will challenge the organization and culture of the future will require much attention and detail—but can also be our strength……….

Evolving this educationally driven infrastructure is definitely a strategic question—one that requires strong leadership and vision for change. It must also be recognized that this is fundamentally about cultural change—world view requires educational growth by individuals, first at a fundamental change level. Individual change is requisite for organizational and cultural change. This type “paradigm shift” is a huge movement culturally, one that takes much time and other resources, both in communities and in infrastructure. Translating a vision into a new “world view” culture will be based on strategies and objectives for change.

**Strategic Planning And Decision-making**

Organizations must have a strategic plan, generally based on an operating philosophy that reflects the nature of the product, the customer, and the overall approach to producing quality at minimum cost. The philosophy should be sufficiently broad to facilitate ongoing changes in objectives with the ability to accommodate ups and downs in the marketplace as well as other factors which must be dealt with. Although the specific task is planning, organizing, commanding, coordinating or controlling, all activities will involve objectives that must be accomplished and decisions that must be made. General objectives in most technological organizations, related to decision making, can be identified around several points presented below.

The organization's basic objective is survival, to stay in business. Other objectives will be less important if survival is not sufficiently addressed.

Profit is also a basic objective organizationally, with much underlying decision making policy oriented toward costs, productivity and competitiveness.

Objectives for growth and expansion which provide an increasing share of the market, leading to additional profits are frequently key to the future.

Meeting customer demands is essential if survival is to be assured. Sufficient understanding of customer demand enables the organization to target the product.

Organizations generally have objectives which reflect treatment of employees. This means providing and maintaining a safe working environment and facilitating workers' achieving their maximum abilities.

Responsible government and public relations, are an objective, if not mission. This translates into paying taxes, obeying laws and regulations, responsible use of resources and the environment, among others.

Organizations may also have service objectives related to product, translating to keeping repair parts on hand, providing a repair division, warranty issues, product seminars, and community service provisions.

Monetary objectives and policies facilitate prompt debt payment, credit use within realistic means, discouragement of kickbacks, avoidance of financial conflicts of interest, and so on.

Well developed objectives give direction to the overall organization's efforts, and careful consideration must be given to their priority, timing and overall impact. Articulating which objectives are primary central emphases, and which are secondary directives to divisions, departments, individuals, and so on is a strategic challenge. This requires structuring objectives as a process, breaking down the primary objectives into workable secondary objectives. Similarly, we must wrestle with employees' personal objectives and organizational objectives. Regardless, objectives should have methods for measurement and a degree of unity and continuity as part of the strategy for the future.

Often, objectives are derived from problems in the organization. If there are too many rejects or the scrap rate is too high, then possible objectives may be:

1. To reduce the number of rejects and scrap in production, while increasing productivity.
These objectives may be satisfactory as secondary (broad) organizational objectives. However, primary objectives are essential for individual work areas or teams. They are more specific, focused and detailed than secondary objectives. As such, primary objectives lend themselves nicely to making quality improvements at the shop floor level. Primary objectives are:

1. To reduce reject rate from 100 units to 90 units at operation XYZ in a two month period; and,
2. To reduce the scrap rate from 1000 pounds to 800 pounds at operation XYZ in a two month period.

Progress must be monitored on objectives, with routine updates for all concerned. It is not sufficient to simply set objectives and get all persons moving in the same direction organizationally. Objectives must be accomplishable within realistic and clear timeframes, and it must be known who is responsible.

One of the true indicators of leadership must be the ability to not only undertake strategic planning, but to follow through and adjust objectives and resources to meet objectives. Evaluation and planning are dynamic and on-going, not simply something that is undertaken for a few days each year. Ideally, based on measurable accomplishments for individuals and work groups, personnel evaluation for promotion and salary increases will be tied to broader organizational evaluation.

Objectives provide direction to the management process for organizations. Decisions must be made on a daily basis to keep the organization viable, competitive, and producing quality products. The decision-making process outlined below is a modified scientific method.

1. Set objectives that can be accomplished.
2. Collect information pertinent to the problem.
3. Identify options/alternatives as possible solutions.
4. Identify strengths/weaknesses for each solution.
5. Determine time required to implement options.
6. Determine costs required for each option.
7. Consider compromises which may be negotiated.
8. Choose a plan, put it in action, evaluate over time.

Decisions, and strategy, must be made based on reliable and accurate information. Questions to help determine quality of information include:

1. Is the information relevant to the problem?
2. Is the information complete and up to date?
3. Is information changing and is it obsolete?
4. Does the information need processed—if so, how?
5. Can we trust information--is it documentable?

Many decisions are made based on our own experience and/or intuition. It is often true that we are inadequately prepared to act on important problems which require decision-making. More objective and less subjective tools should be used and blended into decision-making. We must seek advice from others and gather information, yet, if we listen to one or two people too much, and they have egotistical reasons for dominating the decision maker's thought process, it can certainly be problematic. Several factors must be considered if the appropriate decision is to be made:

1. Will future automation impact current decisions?
2. Will public attitudes or governmental regulation affect/impact the success of the decision?
3. Will changes in the economy or general costs affect the decision?
4. Will changes in foreign policy or the local/regional competition affect the decision?
5. Will changes in labor market, necessary materials, suppliers or transportation impact the decision?

As we assess the issues, we all must have an open mind and be willing to look at the experiences of others.

Certainly, in all decisions, some common sense rules also apply. Do not become involved in the wrong decisions. If authority/responsibility has been delegated, let the appropriate people do their job. Be sure to have a contingency plan so that, in the event that the first decision does not work, you can fall back on plan two. As with other elements of the decision making process, do not procrastinate too long. Not only does your credibility begin to suffer with those around you, but also, the longer you wait, the further the competition moves ahead. But, do not make a snap decision. Rather, make certain you have adequate information prior to making the decision. We must be realistic about the decision. If the decision is going to upset too many people, is it really worth putting into action? How much change is the decision going to create? Will the change lead to instability in the organization? The extent to which effective decisions are made in organizations will clearly set the tone for quality and productivity.

Fundamental to the process of change, and strategy for the same, must be the recognition that we have a global community, one that requires a world view. The world view will give rise to new challenges in decision-making about resources and pace of movement in change, as well as strategy to do same. All of this, while cultural, is also about fundamental values which are tied to technological management and thinking. Ultimately, much about the future must be considered alongside how
we have gotten to where we have been, and where we are.

Understanding Traditional Values Changing

Technology is about change, and cultures develop new and different values as part of that change process. Traditional values are also experiencing change within the technological culture. In this section we explore change in traditional values in physical work, personal relationships, independence and freedom, a relationship to nature, leisure, and permanence.

Each of the values cited are shown as being impacted, and as interrelated. While they are being impacted, we are also evaluating the change within the context of our values, even as they are changing along with everything else. This would seem to explain the process of resisting change. All is happening in the broader context of micro and macro cultural infrastructure, including families, organizations, communities and regions—all important to our future.

Not so long ago the value of physical labor was held in high esteem by society. How many parents today encourage children to become ditch diggers, mechanics, farmers, or any other physical occupation. Technology freed us from the drudgery of many unpleasant, tedious, dirty, and downright mundane tasks over the last one hundred or so years. Many types of physical work we used to value no longer exist, thanks to technology.

We do not value physical work in the same ways as we once did. Technology places more value on 'thinking occupations' than on physical work. Technological culture is saying we value persons who create and understand technology and innovation, by the very way we distribute wealth, changing nature of work, and as evidenced by products and services people are buying and using. The changing value of physical work is also tied to technology because many persons associated with creating the technology to displace workers or change the nature of work are a part of the 'thinking group.'

Traditionally, taking the time to sit down and talk, spending real time with persons, and making personal commitments to others demonstrated personal relationships. Individuals had a willingness to get involved for the sake of friendship, helpfulness, and other non-financial reasons. These values are changing due to various technological circumstances.

Periodic changes in our lives, due primarily to the dynamic and changing technology, cause us to race to stay up with technology, often at the exclusion of family and friends, particularly over the long-term. Technological demands press us to commit time and resources, encouraging surface relationships, but seldom will sustain long-term in-depth personal relationships. As we move forward in a career track it may even be disadvantageous to have close personal relationships which distract us from focusing on the work, driven largely by technology. We may change jobs every two or three years, or even more, live in a community different from where we grew up, and tire of maintaining long term relationships under such circumstances.

Is this changing value evidenced by the technological cultures' divorce rate, single parent families, youth raising themselves, and perhaps other signals being given by demographic indicators for our culture? Is it possible that our inability to form and maintain close personal relationships, upon which much of life has formerly been based, is also at the root of drug and alcohol use and abuse, spousal and partner abuse?

The changing values of personal relationships are driven by our increasing reliance upon technology as the other element of our personal relationships. Some individuals rely on alcohol and drugs technologies to develop personal relationships. Many people, particularly children, watch six or more hours of television daily, but seldom speak to another human being. Individuals are more comfortable working with their computer or speaking on the telephone, rather than interacting directly with other people. What do these activities tell us about the changing value of personal relationships?

Independence and freedom are traditional values which date clearly to the founding of our country. Most people in our culture relate heavily to these values, and they should. Technology has incrementally eroded away these values in a traditional sense. Although we were scarcely aware of it, the fact is, the concepts of independence and freedom have shifted so dramatically from the days of our founding fathers that we no longer think the same way about these concepts in the same way. Our founding fathers viewed independence and freedom in terms of religious and political expression. Contrasting earlier values, many choices of independence are manufactured choices and options, contingent upon technologically related options in work environments.

Independence today may mean driving down a road in an automobile, having one's own living quarters, or some form of financial independence. It may also mean having the ability to choose from among technological options, where one wishes to live and work, or what one wishes to study. Today freedoms may be associated with controlling one's personal information, such as not allowing personal information to not be used without permission, such as being placed on a mailing list. Perhaps receiving phone calls even though we may not want them may compromise our concepts of independence and freedom. Feeling free to move about in a community without threats to personal security is a substantial shift in independence and freedom, culturally.

But virtually gone are the days when independence and freedom were measured in shifts from ones' former culture, as in the case when America was colonized away from Great Britain. Values of independence and freedom
are driven, like all else culturally, by the technology. Independence and freedom have shifted to be indicators of the amount and type of technology one has control over.

Our relationship to nature has changed. As we became increasingly technologized we have incrementally disengaged ourselves from nature. At the start of the 1900’s, we were generally in touch with our natural surroundings, typically through farming, but also simply by the approach we took with living. We did things more slowly and less mechanized. As the pace of life increased and we have become increasingly mechanized, so have we increasingly disengaged ourselves from nature. Many people are so disconnected from their natural surroundings that they now believe "fresh air" is a function of air conditioning, moisture in the atmosphere is a function of a dehumidifier, and getting a tan is only done at a tanning salon.

As we have become disconnected from nature, we also have begun to devalue it. We are destroying rain forests at alarming rates and have created holes in the earth's ozone layer. It will take decades to clean up industrial and technological waste sites and other polluted areas, and at significant costs.

Technology tends to isolate us, at least temporarily, from some nature and some of the things we are doing to it. We haul garbage away so we don't have to see or smell it in our own backyards. We bury the industrial waste by-products, and put catalytic converters on automobiles. However, we must de-isolate ourselves and rebuild our relationship with nature in reasonable ways. We have done serious damage to our current and future quality of life by not maintaining a good relationship with nature.

Traditionally the value of leisure has meant activities as simple as reading a book. Significantly, it has also meant personal contact with people such as visiting with friends and family, playing on athletic teams in the community, or other community-based events and activities. Leisure was traditionally greatly concentrated on Sunday, almost always a function of the 'day of rest.' On Sundays the leisure functions were largely organized around church, involving worship, picnics, sports, and community activities. Almost universally, church was involved and there was a 'faith building' relationship.

As the concept of community was expanded with the automobile and industrialization, people began to experience leisure elsewhere, primarily a function of the lure of the larger cities. With the great individual independence and freedom, the church and community gradually lost ground as the focal point for leisure. In addition, the advent of radio and especially television, the concept of leisure took on yet additional meanings.

People were idling away hours glued to the television, engaged in a one-way relationship with what became known as the 'boob tube.' People really did not communicate with one another when the TV was playing as they did with parlor games or visiting. We became so absorbed in TV that we were virtually lost in a non-reality, helping to change the value of leisure from people contact to an escape mechanism. A few years later, the advent of new technology in the form of computer games continued to keep people glued to their screens for hours at a stretch and further separated from each other during leisure activities. Leisure has passed from a people-to-people activity to one dominated by technology.

A few short years ago an individual could be reasonably assured that he or she would be born, live, and die in the same community--a key concept in the traditional value of permanence. We are witnessing a large-scale shift in the way we view permanence in our lives. Mobility in the technological culture means not only that we could move about rather freely in our own culture, but we have become somewhat worldly as well, primarily a function of wartime activities and trade across the years. As a function of work in our culture, we have redefined the notion of mobility, recognizing people will likely work in several locations in their careers.

Permanence has not only been affected by our physical mobility. Another significant factor is change as a permanent part of the technological culture. As change occurs in a community, organization, or home, primarily driven by technology, how can this help but not affect the way we think about permanence? It would seem that we might even subconsciously try to anticipate change, and therefore changes in our personal concept of permanence might also be affected--both good and bad. On the one hand we may try to prepare ourselves for the change in our 'permanent' world. But on the other hand we may have indirect anxieties as a result of the changes.

Our lives are composed of on-going change and constant differences from the day-to-day as well as over the long term. As products and activities change in our culture, it is a foregone conclusion that our values related to permanence must also be changing. Culturally we must consider several issues related to how the technological culture values permanence. Is this bad? Is this unhealthy? Is it unnatural? Is there an optimum rate of change associated with values and views of permanence? How would this be determined?

A final point is presented as being pivotal within the broader context of culture and change. This relates to civility. Civility is addressed as one of the areas connected to values of technology which is undergoing change. Civility is explained as actions by individuals and in groups which are appropriate to the situation. As we have become increasingly technologized perhaps are less able to interact with each other in socially acceptable ways. Aggressiveness, lack of cooperation, assertiveness, harassment, and other behaviors which are acted out against others are but a few of the civility issues which can be identified. How we control these behaviors to the benefit of the broader group, without taking away rights of the individual, is a fairly important question.
Traditional Institutions Under Pressure

But what do all of the changes in values, driven largely by technology, mean in terms of cultural functions and day-to-day activities? If we have evolved with technology, and are essentially products of the technological culture, is it really a serious problem for us? It seems quite reasonable to assume that technological culture and several key institutions are undergoing substantial change associated with shifts in values and other relationships. Changes in family, church, school, work, government and infrastructure are presented.

Family has traditionally been the glue that binds society together. It has been said that as goes the family, so goes the society. In the technological culture we have gone from a traditional family structure at the turn of the century to a rather non-traditional family structure today.

Family, at the turn of the last century, was a large unit immersed in farming. Grandparents of farming families often lived nearby, along with aunts, uncles and cousins, as an extension of parents and a cushion for financial and moral support. Large families assured not only the required work force, but also constituted a 'social security' system for the parents, assuring care for them in their latter years. Values were different and technologies and methods for birth control were not nearly as sophisticated as they have been during more recent times.

As factory mechanization was occurring similar principles were being applied in farming operations. As the lure of city and high paying factory jobs pulled people from the farm, family farms changed. Increased productivity occurred with less people. We saw a radical shift during the twentieth century, from farming families to city-dwelling families. The net result was a family with a different purpose relative to earlier farms.

As families became increasingly mobile, leaving the traditional home place, the extended family concept was all but lost. Not only was the support system challenged, but new needs, particularly for the young and old, became evident, and their value to society shifted. The shift has been so radical that children in modern families outside of marriage, and so on in seemingly record numbers. Our technological culture must find new ways to fulfill traditional extended family functions with day care centers, nursing homes, and support groups.

The basic question is whether or not changes in the family structure pose a threat to our technological culture? Some suggest that many of the problems and issues creeping up in our culture may be related to the break-up of the traditional family. It is entirely possible that social disorder and general lawlessness are at least in part a function of family dysfunction within the system.

Another core part of the culture not so many years ago, was the church. The church, along with family, have traditionally provided pivotal foundations for our culture--but technology is challenging these foundations. New needs created by technological changes are providing challenges to the church in ways not ever noted before. Competing interests for our time, financial support, and other resources require us to make choices. We are choosing to put our resources into organizations and activities other than the church, at least in the traditional sense. Although many non-traditional, non-mainline churches are growing and gaining ground today, many traditional mainline churches are losing ground, and members. Many see traditional religion as irrelevant to the modern society and their own personal needs.

As the technology became an increasingly pervasive force, it has overtaken the influence once held by the church. The values of technology are extremely powerful. We have simultaneously given up some other elements and traditions of our lives. It may be that people no longer think they need religion. At the turn of the century, being generally dependent on farming, our concept of God was perhaps heavily oriented toward our relationship to the land and our faith that rain, seed and hard working of the land would produce a crop, and we could carry on. As we have become increasingly technological we feel more in control of our environment. We have taken a position that much less should be left to chance, or faith. We now believe that in a rational and efficient world we no longer must believe in that which we can not see. The church and religion may have become irrelevant, and less than useful, in the process.

People will never be as rational as technology, nor should they be, else we would essentially be technology. Technology can feed our stomachs, but not our souls. We have a fundamental need for spiritual nurturing and require spiritual outlets in the form of religion, as has always been the case. This does not mean needing to be told what to believe or what morals or values are correct or incorrect. This reflects the current conflict the church is experiencing with the technological culture. Intelligent people do not need to be told what to believe, but they still have spiritual needs well beyond what technology can
provide. Many churches are doing what they have always done, built on the traditions that made our culture what it is. Church must change to be relevant, adjusting how it meets needs in a technological world.

Another traditional institution under pressure to change is the school. Education is particularly important in a technological culture since the schools are pivotal in disseminating the technological knowledge. Schools can either be reactive or proactive. A reactive schooling system would teach how to accept change after the change has occurred—a shock absorber type system. A proactive system, by contrast, would teach how to change and actually drive the change. They would not just react, but anticipate technological change and teach it.

Although schools have traditionally done a reasonably good job in many respects, they too have failed to respond to changes in technological culture. As technological pace of change has increased, schools have basically stayed the same, becoming less and less relevant as the culture continues to become increasingly technological. Whether by chance or design, schools have become a 'shock absorber' type system—reacting rather than projecting the future. We should remember, the extent to which schools have been asked to "backfill" for families and the church. Schools must teach morals and values, whether they should or not, and they are often merely babysitting where parents once were prime caretakers. This is part of the current technological shift.

Significant change must occur in schools to make them relevant to the needs of the technological culture. It is quite likely that the nature of changes required in schools will need to come from outside the education system rather than from within. If changes could come from within, why have they not already occurred? Change in our education system will be driven by private schools, industrial organizations, community advisory committees, and other non-traditional entities.

We have seen tremendous change in the institution of work, particularly during the current century. Most of the changes have been mentioned elsewhere and are summarized here to assist in showing the extent to which this, and other, institution(s) have changed—or are under continued pressure. Examples include shifts from:

1. Farming to manufacturing or industrial work.
2. Manual labor to non-physical work.
3. Low-skill to high-skill knowledge work.
4. Crafts to mass production type work.
5. Non-mechanical to automated work.
6. Manufacturing to service oriented work.
7. Manufacturing toward information base.
8. Full time work off site to contracted work at home.

While other pressures can be identified, it is important to acknowledge that this is occurring and that it is significant within the broader context of our multifaceted culture.

Our government and infrastructure is under pressure to respond to changes in the technological culture. Government is constantly striving to stay ahead of the technology. As with schools, it is not enough to simply respond. Government must take a proactive position with the overall infrastructure.

Problems and issues in our culture, and throughout the world, today are diverse, complex, and clearly primarily and fundamentally technologically driven. Our government must be more adept, anticipating changes and preparing to respond to all technological challenges. This may be specific technical training for elected and appointed officials, electing and appointing individuals possessing technical backgrounds, or other methods. We need more technical expertise integrated in government.

The entire infrastructure must be made technologically sound to strengthen our government and the overall system. This will mean that health care, transportation, utilities and all other entities will be more innovatively dealt with, matched up with the technological culture which is driving the problems and issues in the first place. We should be looking forward to 'electronic' town meetings, enhanced data handling systems, high speed rail transport systems, and much more as we organize and conduct our government and infrastructure to function more technologically.

Characteristics Of Technological Culture

If we are to understand technology, we must first become more knowledgeable about technology. One way is by considering various characteristics which help explain technology, including behaviors, its nature, relationships, and why things happen the way they do. Characteristics discussed are those which provide the most insight about why technology is the way it is.

Characteristics identified and explained are organized to flow from production through an explanation of the physical nature of technology. The characteristics are presented in a continually expanding and evolving approach, intended to provide additional foundational information for persons who live with and use technology, but do not necessarily understand and appreciate technology inherent in the fabric of their lives. Characteristics are thought to be reflective of values, but of a transitional nature. As our culture continues to change, as a function of the technology, characteristics may not have the lasting nature of core values, or they may actually provide the base from which much of our core value system arises. These are of vital importance, like core values, for helping us understand our own behaviors and actions, as individuals and organizationally.

Production orientation. The human condition and production have always been linked. Consider that
everything we do as humans (regardless of historical, geographical, or cultural orientation) is a **productive act**. When we suggest technology is productive we do not necessarily mean that all outputs are beneficial. There will not be unanimous agreement about the benefit of produced outputs of technology. Simply because something was produced, was it necessarily productive?

Regardless of how or when we observe technology, whether in a dynamic manner (in motion) or in a static manner (not in motion), we view technology as production oriented. Technology could not be if not for human inputs to reshape materials and resources into some system for accomplishing productive acts. Even though technology is at some point sitting idle, it still required a production system to bring it to fruition. It seems reasonable to conclude that **technology is production oriented**.

One early characteristic is that **production presumes consumption**. If something is produced, it would seem reasonable to assume that consumption will occur as well. Technically, it could be argued that consumption in the conventional sense does not necessarily have to occur. If one considers the Edsel automobile, for example, produced in the late 1950's, we recognize that not all industrial products are going to be consumed. From a technological and production perspective it is simply not a logical and wise business decision to produce product if a market is not demanding the product. This suggests society wishes to have the productive act brought to fruition and marketed for consumption, assuming all production reflects the market, and forces acting on production are consumer driven.

What about individual acts and behaviors, particularly as related to technology? In a free society where all participants can do as they please, within reasonable limits and as defined by laws, should there be limits of technological production and consumption? Just because a person can produce something--either an act or device--does not mean we should do it. The field of medicine offers many examples--such as keeping individuals alive via technologies when it is obvious that their body is well over-extended. Yet if one individual produces a technological device for their own consumption, it would appear that this is acceptable. What if people do not "build to code" or follow rules?

The reality that **production presumes consumption** also causes other interesting behaviors related to technology. For example, if the technology being produced is truly shoddy but has an exceptionally talented marketing team, perhaps the product will sell like hotcakes. Conversely, it is equally as likely that a top quality technological product that is not well marketed certainly stands a fair chance of falling flat on its face in the marketplace. However, the reader would be wise to remember the technological products and services do survive quite well in the marketplace with no marketing other than word of mouth--simply through the grace of good quality in production. Consider for example the local house builder, mechanic, garage, or merchant who does no marketing yet keeps plugging along successfully.

And to what extent has the production-presumes-consumption mentality affected our behaviors regarding the "throw away" mentality so evident in our technological culture? Mass consumption presumes mass production. Part of the requirements of the mass production cycle is the need to only partially consume, rather than completely consume any product. For example, we throw away clothing primarily because we think they are no longer stylish. We virtually disregard the reality that there could be many years of life left in the clothing--not to mention that we tend to overlook the real utilitarian value of clothes and other products as well. Another example of our "throw away" culture is the number of automobiles scattered throughout fields all across the countryside. They are discarded simply because we do not want to be bothered with real and comprehensive maintenance, not to mention stylizing, again. A more evident consumption issue in our mass-production mentality are partially eaten meals, leading to significant waste--not that anything is actually wrong with the food, we simply do not eat it, and it gets thrown out.

Products really should be fully "used up" prior to throwing them away. This relates to **planned obsolescence**, designing and building products of minimal standards and materials. The concept pre-designs the likelihood that a product will fail and lead to the need for a new one. It becomes apparent that the need to replace the "consumed" product leads to more demand, and ultimately more production. It may, therefore, be possible to conclude that it is in the best interest of the producer to design from the standpoint of planned obsolescence, and be given the opportunity to produce and sell more units.

It is easy to see that much of the non-consumption of products could correctly be labeled waste. If we throw away good products that can be repaired, recycled or simply still used, it is waste. By-products we create, and the way we produce, package and ship them, may be wasteful when they are just left over or thrown out. While possibly cost-effective and profitable in the production cycle, by-products also may be wasteful because of various disposal needs.

Another characteristic is that **technology requires resources**. Resources are required in at least three ways for technology to become a reality. First, resources are required to create the technology. Technology is basically various resources transformed or manipulated into something that is perceived by someone to be a need. By molding or shaping materials with machines and
handwork into a product, resources are used to bring the technology to fruition. Second, resources (whether electricity, fuels, human input, or other) are required to power the technology once produced. Third, environmental resources will be affected through technological applications. Irresponsible extraction and use of fuel sources is not being mindful of the future.

A clear relationship exists between consumption and waste, and resources. First, as we waste in the production-consumption cycle discussed earlier, resources are being consumed. Second, as the residual materials in production and consumption are disposed of, the environment suffers as we fill up land fills and create dumps. Third, on-going use of technology requires resources to keep it going. In all cases it must be underscored that technology in virtually any form will create ongoing requirements and impacts on resources.

Another major characteristic is that humans require technology. As part of technological production, it is vital that selected human issues be brought into perspective. From the earliest days, regardless of how people existed, they developed and used technology as part of culture. Functions of technology have to do with production of daily needs for survival. Whether communication, transportation, manufacturing or other fields of technology, productive outputs remain a motivation.

Hunting and gathering for food produced enough food and other materials to sustain life, eventually leading to development of increasingly sophisticated tools for killing animals, processing meat, and producing grains. Production of fire and tools for agriculture and domestication of animals, leading to conventional farming in one location over time, were significant production developments. It seems reasonable to conclude that humans still today, as has always been the case, require technology. If we consider all that we do, and all that we are about in any given culture today, but in particular American society, production is the most important technological orientation. Workplace efforts, as well as general efforts in the home, are oriented toward providing outputs ultimately leading to producing the "good life." Considering realities of recreational activities, the useful output is oriented to producing rest and relaxation, as a function of productive recreation.

One additional part of the production equation is that technology is a productive output. One of the characteristics of productive output centers on whether or not outputs are necessarily productive. It seems appropriate to suggest that how persons view productive outputs is perhaps a matter of personal choice, values and interpretation. What may be regarded as a productive output by one may not necessarily be valued as a productive output by someone else or another group. For example, a group of persons may create electronic music via numerous technological tools and techniques, and generate a tremendous following of persons who truly view the music as a productive experience. Others may consider the electronic music to be counter-productive and a complete waste, noisy, and degrading.

**Technology is both good and bad.** One significant technological characteristic relates to technology’s ability to be both good and bad. We will explore this issue first from the vantage point of general considerations in various broad views, then a values orientation, next from a moralistic approach, and finally via ethics.

An important characteristic is that technology provides choices and forces decisions. Day-to-day choices and decisions that people make are, to some extent, influenced by views about the goodness and badness of technology. Virtually all decisions at all levels are either directly controlled by, or at least influenced by, technology. If my view says that automobiles are bad because they have the potential to injure and/or kill people and pollute the environment, it may be that I will take action to determine other means of transportation. I may develop the view that selected food production techniques, namely feeding grains to beef cattle and killing for meat, are bad and I become a vegetarian.

A second characteristic is that technology causes conformity. Technology has the ability to create ever more increasing choices for people. A natural inclination toward enhanced efficiency in technology tends to gravitate it toward methods and systems that increase production output. But this then provides only limited choices, which essentially "forces" people into the choices available, creating what is known as conformity.

The paradox is that people are afforded more choices, but the choices tend to be the same choices available to others. People actually desire the same clothing, automobiles, houses, and myriad of other consumer goods possessed others. Perhaps it could even be argued that technological choice limitation and conformity is somehow counter productive relative to creativity. Prior to mass production many created their own finely crafted and creative products. Mass production and conformity to available product choices caused people to not perform their own single person production in favor of consuming cheaper mass produced goods. People also became less and less likely to want to create their own single person produced products. At some point we become what the technology wants us to be and are forced into something other than the spontaneous, creative, "do it my own way" kind of individual.

It could be argued that putting more mass produced goods in the hands of the general populace has been at least part of the key to increasing the standard of living for many. Consider that those same choices have diminished craftsmen creativity and contributed to
consumer conformity to technological choices.

Finally, there is a fine line between conformity and leadership. When leaders require strict conformity to belong to the group or organization, it may be a signal that something is not right. Perhaps a startling example of this concept of required conformity was applicable, at least in part, during World War II when Adolph Hitler forced masses to accept his point of view. We must not allow this destructive activity to happen in organizations. While there is a clear need to have people in an organization thinking and moving in the same direction, it is also true that creative and innovative people often are not known to conform. Good leadership provides structure and encourages us to create and innovate.

Third, technology elicits values. Technological choices and decisions also elicit values. As we make choices and decisions we are demonstrating and acting on our values. But what are values and how do they relate to technological choices and decisions? Values are those elements of our lives and culture that we hold in high esteem, or revere as having high worth. One person might have strong values that hold religion in high esteem, while another values the environment. Perhaps most of us strongly value our personal and social freedom, and perhaps equally as much, our privacy. Consider technological choices, decisions and values:

1. If I buy a gas guzzling auto, might it indicate values of other than frugality?
2. How many square feet of living space are needed? Is it a value of wastefulness, or a value of freedom?
3. If my auto emits pollutants in the atmosphere what does it indicate about my values?

Technological values raise several interesting dilemmas regarding modern life. For example, automobiles have afforded many freedoms such as the ability to drive and move about with considerable freedom. Yet we are also perplexed with massive traffic jams and gridlock which clearly do not enhance personal freedoms. Few would argue that the electronic age has brought about many benefits to modern life such as computers, calculators, stereos, and advanced medical and health care. But, the personal privacy we so value has been invaded by electronic technology through surveillance techniques, computer generated mailing lists, and data banks on credit histories. As mass communication systems proliferate, we will see mass control and manipulation of values to set the future tone.

A fourth characteristic identified is that technology drives ethics and morality. Morality could be defined as the rightness or wrong-ness of a given situation or set of circumstances. Ethics is an extension of morality that applies to rightness or wrong-ness in a professional sense. But how does technology drive ethics and morality? First it must be recognized that the choices and decisions we make are essentially all related to technology in some manner. Most choices and decisions also have to do with right and wrong, circumstances related to technological ethics and morality in some manner or another.

One area ethics focuses on is product liability:

1. I conceive an idea and someone else draws up the designs for the idea. Later, the design is shown to be faulty. Who "owns" the idea in such a circumstance? Who is responsible?
2. A designer draws good designs but a producer manufactures poor products, who is responsible?
3. A product properly designed and produced but consumers misuse product and are injured?
4. How much knowledge is needed for technology?
5. How do we know product literature is properly written, proper use or procedures for consumption?
6. How to conclusively prove responsibility above?

Another key area of technical ethics has to do with social responsibility. Even though some liability situations above may seem baffling, most liability cases are relatively clear cut when compared to some more complex social issues related to technological ethics. Consider where people are starving in various parts of the world at any given moment, at least in part due to poor technological distribution systems. Both the food and the technology is available to remedy the shortages. Is it ethically right to feed people who are starving and not provide education about various issues required to meet the demands of the modern world? This question is particularly critical in light of necessary contraception and other amenities of the technological culture having to do with control, both social and technological.

It is ethically incorrect to give people technological tools without giving them the necessary information to adequately and properly use and control the technology. Ethically speaking, presumably at least part of the reason some persons pursue careers in technologically related fields is because we wish to improve on the overall circumstances for people. This would seem to preclude a need to provide ethically correct behavior on our part. Most of us only want to do what is technologically correct for people. We endeavor to help users of technology be well equipped with proper functioning systems and devices as well as needed information and training.

But many opportunities and vulnerabilities exist in the broader technological system. There is a fine line between helping people by providing a profitable product or service, and taking advantage of an opportunity requiring expertise, charging a lucrative fee for services.
An additional characteristic to consider is that technology thrives during wartime. Perhaps no other point illustrates the good and bad of technology better than wartime. A clear relationship exists between amount and types of technology and the ability to respond during wartime. Not only does technology escalate during wartime, but it also is part of the requisite for war. If a country wishes to be a player in international politics and peace as well as wartime activities it requires technology. The amount and type of technology possessed will directly relate to the amount of clout a country can wield on the world scene. Although many people disallow it, technology is evolving full tilt and the economy is in full swing when at war. Aside from innovation during wartime, technology is good and useful as a war machine.

Yet at what cost is wartime activity occurring? Should technology be at its healthiest in terms of evolutionary cycle at the expense of people and destruction that occurs during wartime? Who would give birth to machinery knowing full well that it would purposefully be used as war machinery, for killing?

Technology causes change. One characteristic readily acknowledged and agreed upon, although not necessarily well understood, is that technology causes change. This is one of the key constants prevalent in all technological activities and functions. Four areas of change will be addressed, each helping providing unique contributions toward understanding change: workplace, infrastructure, community and home, technological development, and, economics and change.

One characteristic is that technology defines the workplace. The workplace must change if it is to stay competitive and remain in business as we move forward globally. Workplace changes will increasingly be driven by technology in the forms of automation, networking, and other electronic issues in several ways:

1. Some jobs are no longer needed.
2. People must learn, due to complex technology.
3. Pace increases—new technology is more productive.
4. New people will be hired as new skills are needed.
5. Anxiety is generated due to lack of control.
6. Confrontations due to new and old technology.
7. Management changes, new jobs and classifications.

For most persons in the workplace, change places us in a reactionary mode rather than putting us in a proactive position. We are not involved in the decision making phases and future vision, let alone which technologies will best suit our needs to achieve competitiveness. This is changing, and technologists are part of the changing workplace culture through participatory management.

Many elements of change in the workplace are applicable to change in infrastructure, in the home and community, and related to the broad areas of development and economics. There are differences and distinctions that make it worthwhile to explore each separately.

Another characteristic introduced earlier is technology, change and the infrastructure. The technological infrastructure was defined as the total delivery system required for a culture or society to function. Taken in total, infrastructure includes all elements required to accommodate the needs of persons living in that culture or society. All cultures have infrastructure. The level of infrastructure sophistication is largely contingent on the overall level of economic and technological development in a given culture. Sophistication and quality of infrastructure dictate overall ability of a given culture to respond with technological solutions to issues and problems in production, communication, transportation and so on.

From a macro view, infrastructure includes health care and human services, schools and educational systems, transportation systems, utility systems, political and governmental functions, religious organizations, security and defense systems, communication systems, recreational and leisure functions, and of course, various production systems. The macro infrastructure being discussed is critical to the overall functioning of the industrial and technological culture. One only needs to consider any of the above general infrastructure elements missing to imagine how an industrial entity would not be able to function. Infrastructure elements identified are assumed to be pivotal to delivery of industrial and technological functions in a developed culture.

As is true in the workplace, technology is the driving force for change in the infrastructure. For example, changes in the schools are due primarily to the need to keep the schools relevant with the technology that is driving the culture and the infrastructure. Significant changes in the health care systems are due to technological advances in the hospitals and in the treatment of persons with devices and technological systems. In virtually all elements of the technological culture infrastructure, to one extent or another, the changes which are occurring are being driven by technology. Equally true for infrastructure and workplace, change is generally resisted. When change is made in any infrastructure element, it can have a significant impact on all other elements infrastructurally.

An additional characteristic is technological home, community and social engineering. Change in the home and the community are also driven by technology. Technologies we may now take for granted and overlook as change agents, such as the television and automobiles, are creating changes in our homes and communities. There are also changes in the macro infrastructure occurring, including, homes and communities being
governed regarding change through codes and ordinances. The value of homes increases or decrease when various developments do or do not occur. Consider land value when a new landfill is proposed in a community near existing homes. Communities undergo significant change if major developments such as highways, malls, and plants, do or do not locate near them.

In the 1960's the social engineering approach to creating change in the home and community was developed. The government sponsored projects in housing, welfare systems, mass transit, large-scale sewage systems, and many others, in an attempt to change the behavior of massive numbers of persons. Some social engineering programs are regarded as failures because taxpayers financing the programs became resentful and insisted the programs be scaled back or scrapped.

Another characteristic is that technological development is evolutionary. Such developments or projects could include community expansion, consumption of resources, evolution of new products and technological fads, and technological change in organizations and elsewhere. The evolutionary nature of technological change and development projects is that they generally move rather slowly toward completion, giving people time to adjust and make changes in their lives to accommodate the new program or project. These types of changes generally move forward in incremental steps enabling citizenry input into the process.

Some people look forward to trying and using new technologies. Others want nothing to do with technological change and new fangled notions. This illustrates that in addition to being incremental and evolutionary, technological change is also momentum oriented. Once in motion, developments tend to continue of their own forces and volition. Momentum reflects desire to continue doing things the way we have traditionally done them. As people become accustomed to the change, it develops a momentum all its own.

Technology, change and economics provide an additional characteristic for study. On the one hand, it is easy to say that all in our culture have an equal opportunity to achieve economic success. And generally it is true that with hard work and much perseverance people can pursue freedoms of the marketplace toward eventual economic independence. But, if one does not have basic and detailed knowledge of technology, he or she is at a tremendous disadvantage. Economic disparity, both individually and collectively, occurs. Technological change and turmoil worldwide exists now as entire countries scramble to democratize and technologize.

We cannot overlook the relationship between development and resources as an economic issue. Resources are required for developing, amassing, and distributing wealth. If the resources are not available, economic development is much less likely to occur both individually and culturally. Thus, economic disparities, and changes, which occur are clearly related to resources of all sorts--people, technology, energy, etc.

**Technology forms the person and culture.** We would be remiss in studying characteristics of technology without also considering the direct effect of technology on individuals and culture. Technology controls our lives, and all functions are technologically contingent, reflected in: humans and technological identity, democracy and technology, and technological determinism.

Consider the characteristics inherent in **humans and technological identity.** Technology forms the person and the culture by shaping the human identity. As individuals, we are shaped by technology at an early age:

1. At the outset existence is due to technology in the hospital at birth. Reduced infant mortality rate is partly due to support systems and health care.
2. Everything from toys, to sleeping and eating systems are of a technological orientation. At a relatively young age many of us are using electronic games and devices (toys). Many prefer the efficient technological bottle feeding system of synthetic milk that replaces the presumably less efficient breast feeding system of mother's milk.
3. Attending nursery schools is partly a function of a desire by parents for their child to become better "socialized" and to get a "head start" on others to be more competitive. It is also due to both parents working to support our technological lifestyle.
4. At early ages we are subjected to television and other technological regimentation and conformity, particularly efficient educationally.
5. Much about education is "competitive", at least in part helping to prepare us for the rigors of a competitive technological culture.

From an early age technology influences us, often in subtle ways, and continues into our adult years, reinforced in various ways. The workplace is technological, continuing to provide our technological identity. Working on an assembly line, programming the computer, word processing, and virtually all occupations relate to technology. Can we work with technology without becoming the technology, even to the point of exhibiting characteristics of the technology. Influences of technology in our culture go well beyond only work. Whatever natural identity might be possible without technology is gradually eroded over time, and we assume a technological identity without even knowing it.

Consider the characteristics and value relationships in **technology and the democracy.** At some point the question "to what extent has the technology influenced
the democracy” may be asked. In reality, the two are effectively and extensively intertwined such that there are virtually no recognizable differences. Outputs from democratic society and technological culture are essentially the same. Our cultural identity is technological. Consider the number and types of agencies and departments in our government that are designed to regulate or oversee technological affairs. Or consider legislation of a technological orientation.

The very natures of technological activity and democratic participation are compatible and complimentary. Perhaps no other form of government is as appropriate for assisting technological activities to flourish as is the free enterprise democratic system of government. Compatibility of technology and democracy is made increasingly apparent throughout the world as several countries and cultures now emulate us.

**Technological determinism** also provides additional insight into characteristics and values inherent in technology. At some point the American view of the world became a technological view. The technological view is etched so deeply in our very cultural fabric that we do not now recognize that this is the case, let alone worry about it. Rather, it is taken for granted and even embraced as the answer to much that perplexes us and our future. When technology and culture becomes so interdependent, as is the case in America, the two are virtually one and the same and individually unrecognizable, technological determinism exists.

There are some vexing questions about technological determinism. To what extent should we be controlled by the technology? How much of our personal lives and freedoms should be given over to the technology? Is it helpful, right and even necessary for technology to be setting the pace, determining social agenda, and dictating other specific and broad directions?

As people increasingly recognize the extent to which technology controls them, difficulties develop. People can be alienated and develop anti-technology views. Perhaps technological alienation and/or rejection is at work in situations where we go on strike over change in a factory, or create head pounding hard rock music, or youth can see no relevance in educational activities.

**Technology is physical.** Disagreements about the physical nature of technology exist. People tend to think of technology as being physical, and rightfully so. We can touch it, feel it, and know when we are using it. There are other characteristics of the physical aspects of technology that are not commonly thought of as such, however. People may have difficulties seeing the physical characteristics in the functioning of technological systems. Controversy also exists in defining the role of people, nature, and spirituality in a technological culture.

It is important to study the technological systems' functioning to better understand the technology itself. Many of us readily conjure up visions of planes, trains, televisions and computers when we think of technology. Certainly such technology is physical in nature. It is not difficult to appreciate the physical nature of technological systems like communication, transportation, and production. We are so reliant and inter-dependent upon these that they are sometimes not obvious to the novice.

In fact, it may not be so clear regarding what is physical technology and what is not physical. Is an atom a theoretical construct from physics, or is it a real physical entity we can discuss and analyze like a machine or a device? Where does nature stop and physical technology begin? Is the tree limb technology? Is the dam built by a beaver in the creek, technology? Is the technique of flying used by the bird a physical form of technology?

Physical attributes of technology can be better understood by studying the relationship inherent in people and technology. Perhaps most pervasive is the question of where does the person fit into the physical technology discussion? Where does technique, manipulating and reshaping our reality, fit into the physical technology scheme for the artisan? Or knowledge and experience for the craftsman or, more apparent in modern times perhaps, for the simple everyday worker? Is technique, knowledge, and experience quantifiable and, physical? Is knowledge and experience technological, similar to a machine or device? What about when knowledge and experience is placed in a computer hardware and software system in the form of artificial intelligence or an expert system? Controversy over physical vs. non-physical goes on.

What is the person's role, whether physical or non-physical? Where does the person leave off and the technology begin? Does the driver of the car "become" part of the technological system? Is the operator of the machine part of the physical system? When, due to automation, a person's role is reduced in physical terms, does system’s operation remain physical?

*It seems that people have no choice but to become a part of the technological system. How can the technological system be a system without the operator? How can the technology have any value if not for the person's placing of value on the device or system as useful and appropriate for a given task or circumstance?*

Disconnections from reality can help us better understand our relationship to technology. Since the beginning of time, when people wore furs, came in the cave, or lighted a fire, they changed reality with materials and technique. The essence of technology is the act of causing changes to environment, or reality. Perhaps the act of changing the environment causes such disconnection that we no longer understand reality. Instead, we live in an artificial, plastic fabricated world.

Increasingly, we may never have experienced a
Physical attributes of technology also may lead to distortions of actual reality. How will we objectively define reality? Which is it healthy to be "drugged" by the technology, we have long since lost control over. Consider the extent to which it is it healthy to be "drugged" by the technology, always high on the disconnection from the physical world of actual reality. How will we objectively define reality?

Physical attributes of technology also may lead to discussions about technology and spirituality. Assuming technology includes technique as part of its world, is it logical to accept that techniques such as magic, psychics, and conventional religion are not technological since they are not physical? Even though spiritual acts deal essentially with non-physical entities, they are legitimate and necessary techniques in the eyes of their practitioners. These techniques are methods of reshaping our realities in much the same way as we reshape reality due to any technique or technological manipulation. Spiritual techniques are valued by users, and therefore, bring a very physical presence to spiritual activities. Observe our desire to worship physical objects within the guise of various spiritual entities or concepts. Conventional religion commonly builds places of worship and has physical symbols and material objects as spiritual rituals.

We might also consider the relationship of modern-day use of technology and material objects to spiritual acts of religion. When we adorn ourselves with the material wealth and technological devices and systems (all material objects and wealth) are we worshipping the technology? When we build large homes, purchase luxurious automobiles and other physical objects, what are we glorifying? What is the difference between worshipping these objects and presumed non-physical spiritual (or physical spiritual objects such as crosses, temples, robes) entities? Are we shifting our spiritual focus from traditional religious values to a technological emphasis, a culture of technology worshipers?

The worship of spiritual entities and activities underscores the reality that technology is non-physical as well as physical, and that religious practices are an essential form of technology. However, the reality that technology has limitations and can fail, or will ultimately fail due to its physical nature, is essentially the basis for religion and other forms of spiritual activities. The question seems to relate more to what form of escape one should choose. Technology and the technological culture only reinforces the need for some form of spiritual activity to escape from the realities of modern technology.

As defined through various forms of religion, spirituality may be in direct conflict with technology. Christianity as a religious example professes love, compassion, and caring for others, possibly even a communal culture. The technological culture is competitive and highly rational, logical and focused toward a productive resource intensive end. While the Christian professes being a good steward of the earth, technology requires exploitation of the environment. Can differences be reconciled? We must consider whether we have simply adapted Christianity in its modern form to be a convenient technique for making us feel good and justifying our technological behaviors.

Technology requires knowledge. A characteristic of technology is that it requires knowledge. No matter how much study, analysis, and knowledge is gained, technology will never be fully under control. It should be our on-going goal to better understand technology and, therefore, better able to control impacts and implications, good and bad. Technology requiring knowledge raises a question about knowledge's alternative--ignorance. The alternative to knowledge about technology is unthinkable. Consider the role of pilots, auto mechanics, doctors without the requisite knowledge to conduct their basic affairs. Even with knowledge, there will never be enough knowledge because changes are on-going in the technology. Our technologically complex world requires that we all know and understand more about what is going on around us. Ignorance reduction, then becomes an important function in our culture. The extent that we choose not to educate ourselves sufficiently will dictate the very fabric and quality of our lives for the relative short term as well as long term future.

Another issue which must be considered is what we will term logical and rational systems. This is based on the reality that technology is logical and rational. We know that certain behaviors will occur under specified conditions. Therefore, we can generalize about systems. It seems reasonable to identify, even in dynamic and evolving technologies, sufficient characteristic behaviors and organize this information for study by others. It is incumbent upon us to organize our educational systems and get on with the essential task of ignorance reduction.

Technology is interdependent and disciplinary. Historically technology and academia have been thought of as separate entities. Secondary school students who wanted a background in technology went to vocational high schools. Post-secondary technology students attended trade schools or technical schools. This may change as secondary schools incorporate technological programs into their course of study and post-secondary institutions offer bachelor degrees in technology.

Although the concept may not be popular in all academic circles, technology must be thought of as related to economics, psychology, physics, chemistry, literature, history, and so on. It is simply impossible to think only about technology as technology. Technology requires other disciplines to explain itself. And just as the world continues to change in general technological terms, perhaps academic terms will change as well. Perhaps
traditional discussions about what constitutes a discipline will change to accommodate technology.

The Global Role of Technology in the Future

It is difficult not to notice the rather amazing occurrences in motion for several years related broadly to democratization, technological and economic development, and defense conversion of wartime hardware to peacetime. Consider cultural and political shifts occurring in several parts of Europe, Russia, China, and elsewhere, in the broader scope of the global evolution. When cultural and political changes are placed in perspective with circumstances related to economic and technological development in places such as Mexico, India, and Africa, it becomes clear that globally there is substantial change in the works. Change, measured virtually any way, is unprecedented in expectations of people and cultures worldwide. These expectations translate into real wants and needs via technology.

Much of the development that has taken American culture several hundred years to arrive at technologically and economically will be attempted by many cultures in relatively short periods such as 10-20 years. We take much of our culture for granted simply because we have always had it around or in motion. The world remains clueless about how to get there, and what it should look like once they arrive technologically and economically. We all must study better how to help development occur in a systematic, planned, and managed way.

As various aspects of these complex issues are presented and addressed, our primary interest is in technology. It also requires tapping into other areas such as economics, appropriate technology, resources, environment, population, values and much more. Anyone who believes these issues can be resolved without technology or technological understanding, is not only naive, but possibly foolish. Technologists must determine and implement appropriate technological answers, assuring and securing a new technological world order.

The future demands more technological functions worldwide to help meet emerging needs of a growing population. The task before us is to build up global technological infrastructure, including both micro and macro functions, enabling conversion of world resources into products to meet global marketplace needs and desires. This is a complex challenge and long term issue. Ignoring the challenge or suggesting that it is not our responsibility, or to think that the global situation will go away, would be culturally suicidal. We must begin to sort out what the world expects of technology in the future.

Keeping the Peace, Meeting the Needs. A traditional role for technology throughout the world has been related to wartime. Building up, maintaining, and deploying an army or other service units requires a substantial commitment of resources, taking away from other cultural activities, functions and available resources. This is neither advocating nor condemning wartime activities. But wartime activities require war machinery which takes resources away from other productive functions. Recent shifts by some cultures from myopic regional viewpoints to an evolving interest in a global marketplace are noted. This is concurrent with a move afoot to reduce various types of wartime machinery. These shifts are significant for several reasons:

1. The downturn in wartime machinery means more technological resources will be freed up for technological functions in other sectors.
2. Additional technological expertise is available in the marketplace for non-wartime related activities.
3. Developments and research efforts can be focused away from wartime efforts and into various world market and domestic issues and needs.

Yet, many good developments and other outputs occur during wartime. As people from wartime functions shift increasingly into non-wartime functions, there is pressure on the overall technological infrastructure for jobs, living accommodations, and other needs. If managed carefully and properly, this necessary transition can occur. The shift in purpose of resources should mean a positive effect on overall technological infrastructure buildup to better meet needs of cultures and the world marketplace.

The distinction between needs is based on level of development as well as expectations of persons in the culture. In highly developed cultures, the needs are relative to maintaining infrastructure and growing more technological functions to feed back into the broader system. Less developed cultures have needs which are much more perfunctory and basic: food, drinking water, basic health care, minimal housing, and so on. Some sections of the world are going to be called on to feed more mouths throughout the world. Those that have advanced health care will need to share methods and techniques with others around the world, particularly as related to birth control. Cultures with educational systems that are in place and working will be called upon to transfer these to cultures with less developed and sophisticated educational systems.

As cultural barriers which encouraged wartime functions just a few short years ago are struck down, the world will become a much larger free enterprise marketplace. People will increasingly become aware of what the 'haves' of the world are doing, and they will begin to strive for much of the same. Key to maintaining world order toward the end of the twentieth century and
well into the next will be to transfer technology, knowledge, goods and services throughout the world into the hands of people to enable them to have reasonable control over their own destiny and circumstances. Technological transfer must be done with great care and sensitivity since people may revolt if the transfer process moves either significantly too fast or too slow.

**Shrinking the World Community.** In an earlier age, it was primarily transportation that extended cultures. Now communications systems serve this function, as well. Satellite transmission, reception and network systems enable rapid movement of various types of information around the world. Various other communications systems and devices, when coupled with satellite communications and transportation systems provide a substantial technological push to some formerly nearly impenetrable geographic locations. As technology proliferates, the world becomes smaller. As connections between and among technological functions such as transportation, communications, and production develop, markets will be extended or built, new contractual and inter-cultural relationships built, and other agreements and entrepreneurial activities will develop.

The global marketplace will be interested in any technological function or product, assuming it is functioning in a competitive mode. That which is not functioning at a competitive level, regardless of how well it may be selling at home, will generally not compete successfully in the world market, and therefore it will not be transferable. Technology, to be successfully transferred, has to be physically present somewhere. Regardless of whose culture it may be in, it is imperative that the technology be working properly on a local level. We must have our technological organizations under control and functioning competitively. Global competition will be fierce in years to come, demanding that organizations be up to the challenge, infrastructurally, culturally, and so on.

**The Nature of Development**

The term 'development' means we are trying to make something happen. If we talk about developing a new type technological system, we must design and plan procedures to bring the project to fruition. If we wish to build a structure, we must perform proper design and implementation plans to move the project forward. This same logic applies in the case of developing cultures. Underdeveloped cultures require additional resources to build up the infrastructure and/or meet needs in other ways. Regardless of level of existing culture, specific elements must be in place for development to occur.

**From Farming to Industrialization.** Americans have virtually transformed our way of life and how we look at the world over the last 200 plus years. We have moved from being a nation of farmers to a nation of people that do various types of work related to technological functions. As we have transitioned from farming to industrialization we have learned a tremendous amount. Going through the development process is part of how we learned what we know, and how we got to where we are. Many cultures do not want to take 200 years to develop in a manner similar to the way we have. Most developing cultures are much more aggressive to acquire the American lifestyle and technology. This is particularly troublesome since values and attitudes which accompany our lifestyle have also evolved over the same length of time. Even where infrastructure and technological functions can be brought on line in a compressed period of time, it is highly unlikely that attitudes and values required to function in a new "transfer environment" could be developed, or embraced.

Technological change should be evolutionary rather than revolutionary. Development is an on-going process, not something that should start up and go for a few months to accomplish specific project objectives, and then move on and deploy infrastructure elsewhere, plundering and plodding as we go. Development must be viewed as an on-going process, consistent with existing cultural fabric and way of life, realizing change will occur in all aspects of culture. American culture continues to evolve and develop, although at a substantially higher level than some lesser developed cultures. Technological maturity is part of the development and transfer process, with some cultures highly matured technologically and others in embryonic stages.

It is inappropriate to undertake development for any reason without considering it as on-going. If a project is undertaken for quick economic gain without looking holistically at the culture and where it is going technologically, as well as in other ways, it may be damaging to the culture. This surfaces in environmental degradation, resource depletion, and so on. Technological change and development projects generally move rather slowly toward completion. People should have time to get adjusted, make changes in their lives to accommodate the new program or project, and so on. Consequences of improper technology transfer and development, over time, can almost assuredly lead to world chaos and destruction.

The nature of the culture which the technology is being transplanted into will make a great deal of difference. If people have some experience with technology being transferred, it can make any newer version easier. If there has been no experiential base, transfer will be slower.

Technological change is also impacted by economic issues. It is easy to say that all in our culture
have an equal opportunity to achieve economic success. Generally with hard work and perseverance people can pursue freedoms of the marketplace and eventual economic independence. Not having knowledge of technology is a tremendous disadvantage. Infrastructure must be in place, emphasizing education for preparatory reasons associated with a particular technology to be transferred. Some prior experience, knowledge gained in various ways, will be helpful for the change process. Given 'haves and have-nots', economic development disparity, individually and culturally, will occur.

Relationships between development and resources can not be overlooked. Resources are required for development and distribution of wealth. If resources are not available (have-nots), economic development is much less likely to occur. Thus, economic disparities and changes which do occur are related to resources of all sorts--people, technology, energy, etc. Malthus, an economist in the 1800's, was the first to recognize this.

Malthus maintained that any culture only has so much resource base from which to support itself. If a culture has a certain number of people who are supported from this resource base, economically they are presumed to be able to support themselves. If the number in the population grows, with no proportionate rise in the resource base, each person has less from which to be sustained. Referred to as Malthusian economics, and in modern terms often discussed along with carrying capacity of the land and other resources. If too many persons or other life forms try to exist on a given plot of land or other resources, it simply may not be able to biologically support, or carry, them. Culture must be able to sustain itself during and after developmental stages. If people cannot be sustained due to inadequate resources, or for other reasons (i.e., perhaps too much resource is being dedicated momentarily to developing the infrastructure), the development project will be doomed. Development conducted under such duress is not in the best interest of persons in the culture.

Third world countries and cultures are those commonly referred to as developing cultures. We place India, China, and some of the African nations in this arena. They have not achieved an industrialized state of development, and they are striving for that status in various ways. This includes level and types of technology evidenced in their culture, types of consumable products, trading nations/partners, and so on. Pivotal in development is the maturity of their infrastructure. Third world cultures generally have resources for development in various ways. Resources such as coal, natural gas, petroleum or others are converted to develop.

Fourth world cultures may wish to develop but lack resources necessary to get moving. Parts of Africa and South America fit this scenario, having dire poverty, over population, ignorance, famine, draught, medical problems, among others holding them back. It is possible that these cultures will never get infrastructure necessary to support development and technological growth.

It is necessary to define development as "international" since many third world cultures are trying to develop similar to American culture focused on capitalistic and democratic precepts. Many third world cultures are moving through development phases America has taken hundreds of years to accomplish. But they are developing in only a few short years, often without having infrastructure or maturity in systems to support development. Thus, difficulties are anticipated.

Development levels can be identified and related to phases of maturity and evolution of culture. This relates to environment of culture, and directions it is headed, as:

1. **Functional level.** We are just beginning to design and deliver basic infrastructural requirements, including extracting resources to develop.
2. **Beginning habitation level.** Basic amenities are in place, people develop habitation and customs, with roads, sewers and schools. Refinement, production of resources increasingly occurs.
3. **Sustained habitation level.** Permanent housing and emergence of communities to mature. Still immature, infrastructure proliferates, and develops.
4. **Recreational level.** Basic infrastructural needs are in place and being met in mature ways with available resources. Production and consumption cycles are expected to be in full swing. Environment may be straining at this phase.
5. **Exploitation level.** Resources are used up and exploitation has occurred--waste and degeneration is apparent--rebuiting of the infrastructure, now crumbling, must be started.

This also points to a need to understand environment as a function of level of development.

Development should be aimed at food production and farming. The emphasis should be on creating appropriate work for persons at the local level. We should also aim for sustainability in the environment. Sustainability should be defined as not requiring additional inputs in the form of energy resources such as herbicides and fertilizers. Development should target a local balance of trade and economy rather than imposed values brought in from another culture or system.

Food production development should aim for an appropriate level of development in systems to help maximize the land as well as other resources. This means targeting multiple local varieties of grains and plants, along with whatever other varieties appear to be most productive in higher volume. Allowances must be made for keeping land productive the maximum amount of time.
throughout the year and growing seasons, as well as having large yields at one or two points throughout the year. A balanced polyculture (multiple plant) approach, versus a monoculture (one plant type) approach helps the local diet and provides enhanced stability against pest, pestilence and other natural disasters such as drought.

The "green revolution", once again recently spearheaded by the US, assisted developing cultures following world war II. Designed to enhance food production of the cultures, it aimed at countering hunger world wide. The basic problem with the green revolution and other efforts spearheaded by the US for developing cultures, was that we assumed cultures should (and could) use techniques similar to those of western cultures, particularly the US. The problem was many fold:

1. Reliance on petrochemicals for mechanized assistance, and for fertilizers and pesticides.
2. Displaced workers by mechanical equipment, particularly hard felt in rural areas where unemployment is high under good conditions.
3. Hybrid seeds were commonly used from other cultures, requiring reliance upon others' for critical seed development and distribution.
4. Mass production and large volumes of one or two crops were often used, disallowing local experience and input. Local infrastructure also was inadequate for mass production.
5. As unemployment went up due to mechanization, people left rural areas, heading for metropolitan areas with higher unemployment than rural areas.

Development in many cultures cannot be addressed or pursued in the same way as it has been done in the US. Each application must be approached as a unique situation to be pursued based on features and elements identified in an individual locale. Particularly related to environmental implications, we need to identify and honor geographical uniqueness. This has to do with the delicate balance of persons and their natural habitat which must be understood and addressed. Environment and resource issues should also be in check when development occurs.

Not all technology should be used in all applications simply because it will do a job. For example, very large four wheel drive tractors which are highly appropriate, if not efficient in the western plains states are virtually non-negotiable in the small fields of many eastern farming states. While large tractors are a necessity in flatlands of western states, smaller traditional tractors are quite effective, and therefore appropriate, in hilly closed-in eastern states' terrain.

Similarly, in many international situations, simply because an industrial technology application has been proven to be quite effective in a highly developed culture does not make it appropriate for all other cultures. Small family farms in third world cultures provide a means of employment, be it ever so meager. Many persons outside metropolitan areas in developing cultures rely on farms for employment. If we mechanize the operations we simply will have many displaced workers. It may be highly appropriate for people in some remote villages and developing cultures around the world to be using manual and low technology approaches--and remain employed.

Closer to home, while by some measures of efficiency it may appear cost effective to put in the more advanced CNC system or machine, what if several persons are displaced and can not find work? Consider that if enough persons are displaced at a sufficiently rapid rate of speed, we may have very few persons available to participate in the enhanced production rates--who can afford to consume if we are not employed and not earning money? Technology must always be implemented in ways which considers possible short and long term effects on the economy at home and elsewhere.

Appropriateness of technologies are able to be gauged against effects on environment, costs in resources, pollution damage based on the technology, and so on--all alongside the impact on people. As with assessment of technology, we must weigh benefits against tradeoffs of technological use and application. It is no small task to be objective about such matters since some gain while others may lose in virtually all technological applications.

Is it possible that part of the appropriateness issue has to do with overbuilding the technology? How frequently have we been guilty of using a far larger technology, or more of the technology, to accomplish the task, when in fact we could have been just fine with no technology, or less technology. Consider that in many cases what we perceive as necessity and convenience may be just that, and if we would simply wait, or do with less, a similar effect could have been noted. How many times, if we simply relax or take a nap rather than taking pills, will a headache go away anyhow? And how many times, if we simply wait or do with less, will it maybe go away anyhow? And how many features on automobiles and in houses are actually required for functions automobiles and houses were intended to serve? How much of technology, particularly that which may be somewhat frivolous, is actually wasteful as well as useless--or at best not required?

A fundamental question which is being raised about technology, is, "do we have a right to develop, interpret and use technology in whatever ways we deem appropriate"? Given realities of appropriate technology and environmental and resource concerns, we have a moral and ethical responsibility to ourselves and our communities to act in accordance with these precepts.

The Role of Technology in Development

Technology is one of the keys to development. Its
importance is evidenced in several ways, all generally parallel to types of technological activities and functions we are familiar with in our own culture. This requires preparing and constructing infrastructure, bringing jobs on line once technological functions are in place, and the unique relationship thought to exist between technology and education relative to upgrading a culture.

**Understanding and Preparing the Infrastructure.**
Sufficient infrastructure is required for technological and economic development to occur. Technology compliments and requires infrastructure and resources. Development, like economic competitiveness cultures are often striving for, is a complex set of circumstances requiring many resources to remain in balance and be effective in local and global economies. Technology is an essential component in the overall mix for development and competitiveness.

Development and competition, like technology, do not simply happen by chance. Design and planning are required for development of infrastructure to bring competitive technological functions to fruition. The level of infrastructure sophistication will be largely contingent on the overall level of economic and technological development in a given culture. All cultures have infrastructure and the infrastructure has a direct bearing on overall quality of life for citizens.

From a macro view, technological infrastructure includes health care and human services, schools and educational systems, transportation systems, utility systems, political and governmental functions, religious organizations, security and defense systems, communication systems, recreational and leisure functions, and of course, various production systems. The micro technological infrastructure includes quality and productivity systems, essential technological knowledge, training and service, maintenance and safety, materials and processes, controlling and managing technology, and, innovation research and development.

Technological infrastructure is critical to the overall functioning of industrial and technological culture. While not necessarily perfect, the American interpretation of a technological culture does represent one effective approach for delivering goods and services. In fact, our approach is so desired that numerous cultures and countries around the world are currently attempting to emulate the American technological culture.

Building infrastructure, if it is non-existent or incomplete, is obviously a massive undertaking. This requires a reasonably skilled and professional personnel pool, and technological organizations which can move projects forward. Infrastructure also requires substantial capital and other resources. Cultures wishing to build infrastructure may not possess necessary resources, and will need to obtain these elsewhere, at least until they have developed them internally to some level. The process is long term, well planned, extensive and comprehensive. Technological development, particularly where infrastructure must be built up, should not be gotten into lightly, nor for quick and easy returns.

Many cultures seeking to build up their infrastructure are also plagued with chronic and on-going unemployment. As people are shifting from the farm to the factory, they tend to move to the cities even when no opportunities are readily available. Migration adds to unemployment problems, as well as making it more difficult for existing infrastructure to carry new persons arriving for jobs that do not exist.

As technology is put into high gear for building bridges, dams, housing projects, roadways, schools, hospitals, utilities, security systems, over time jobs will be developed. Part of what should be added to infrastructure should be new jobs via production activities such as manufacturing, food processing, distribution, transport, research and development, governmental agencies, and a myriad of service sector type jobs.

An intimate part of the whole process involving development and technology transfer is the knowledge transfer which must accompany the technology. It has perhaps appeared that the technology could simply be taken to a site, unloaded, set-up, and placed into operation, similar to the way it is done in America. The developing culture, with an emerging infrastructure, will not necessarily have service shops located close by to support technicians, and in fact probably there will not even be any technicians. People in developing cultures have little knowledge of technology being brought in. It is incumbent upon technologists to help enlighten local persons. Various agencies will need to pool resources to set up schools for education and training beginning early in the overall technology transfer process.

The nature and quality of the American educational system is part of what has gotten us to where we are. Thus the educational system cannot be for training only, although this may be a foundation in the basic system. It would be wise to include various types of general education relating to human communications and calculations, among others. This will be pivotal to sustain long-term growth and economic vitality. Remember that everyone learns in transfer. Transfer of technology places all parties in circumstances which force collective answers. It is the dynamic of a two way street that results in such exciting and challenging activities.

**Levels and Appropriate Technology.**
One of the elements involved in technology transfer and economic development is related to matching technological functions being transferred with capabilities of the local infrastructure. It makes eminent sense to assess the level of technological functioning and infrastructure in local
and regional surroundings prior to beginning a transfer project. Once assessed, the level of appropriate technology to be brought in can be better determined and more readily applied when ultimately installed.

There are generally considered to be various types or levels of technology. These are identified as low technology, intermediate technology and high technology. Low technology is associated with crude manual devices requiring human or animal power and relatively low skill to operate. Intermediate technology is powered by electricity, and it has various types of low level mechanization such as belts and pulleys, gears and sprockets, and so on. It requires some skill, although people with general mechanical aptitude and skills could learn how to use intermediate level technologies quite readily. High technology is generally associated with the computer, robots, CAD-CAM systems, and automated factories. High skills and well educated people are required to use these tools and technologies.

What does level of technology have to do with transfer for technological and economic development? Appropriate technology means technology is selected to be compatible with existing resources, industries, way of life and general attitudes and values of people in the area. High technology is not simply placed in a community which has traditionally used oxen for its power source, even if power for the technology could be arranged. If waste and sewage treatment facilities are not appropriately configured to handle affluent being outputted by a proposed producer, and no allowances are made for the same, this is inappropriate. Appropriate technology speaks to impacts on people as well. If technology being proposed for transfer is not appropriate for people involved, then it is not appropriate technology.

**Diffusion and Adoption.** Part of what must occur in technology transfer is related to diffusion and adoption. Diffusion is the act of placing the technology in selected physical and geographical locations and installations. Diffusion is part of the required development and transfer activity, but we must be careful not to assume that simply because the technology is placed somewhere it will be used, let alone used correctly. Simply because technology and necessary infrastructure are in place does not insure that useful outputs will occur. Technological activity in and of itself can be quite damaging—particularly if not carefully planned and implemented.

Assuring that a diffusion program for technology applications is actually successful, appropriate adoption procedures must be in place. Adoption relates to the overall transfer and development plan, the infrastructure planned and/or in place, levels of skill possessed by local persons, and a myriad of other functions and issues. It is key that adoption not be overlooked, and that it be articulated with the broader diffusion, development, and transfer plan. The extent to which adoption and diffusion are not clearly addressed in the design stages and followed through on in transfer stages is a function of the long-term lasting value of development strategy.

**General Development Issues**

Is development all good? Might there be a down side to some of what has been talked about? Certainly from the vantage point of the underdeveloped culture and persons, people in American culture have it pretty good: Two or three TV's, three and four bedroom homes, two cars in every drive, indoor plumbing, and cooked meals on demand are part of what is envied and being sought after by an increasing number of people and cultures throughout the world. But what most people around the world do not understand is that there are always trade-offs with any form of technological activities. Development brings traffic jams, smog, plant closings, training schedules, new roads and buildings where there once was farm land. Particularly in development modes with cultures somewhat or very unfamiliar with technology, they will likely not know much about these types of issues and circumstances. The American culture has evolved over several hundred years, and in increments which have been reasonably manageable over time. Our infrastructure is mature and even in need of substantial repair in several areas, yet many cultures are still struggling to bring various parts of their own infrastructure on line initially.

**Missionary Zealots Beware.** Much early development was done around the turn of the century by missionaries for various churches, around the world. While this is inherently good a fundamental question must be raised in reference to the missionary zealot approach to development: Is it appropriate to impose our values on persons around the world, from other walks of life?

Some may argue that this is a moot point, and not even an appropriate question. But it would seem to be an essential question, particularly from an ethical standpoint, since it is generally true that persons receiving the mission work did not always request it. Perhaps the most compelling part of this issue is that once the values and attitudes of our way of life are instilled, what is the next step? Where do the people turn for further development, generally based on Christian values and ethics? Regardless of whether it is values and/or technology, is it appropriate to impose our technology and/or values on others? What makes this right? Is it simply that we think it is right? Is it our view of progress versus other persons' view? Particularly when we are out of our own culture and geography, it would seem that this entire scenario should be carefully considered.
Several countries and cultures currently moving rapidly toward democratization are formerly communist countries. The economic approach traditionally taken in these cultures was radically different from the approach used in our own culture. We have developed a way of life around the free enterprise approach to thinking and functioning. This is part of how we have accomplished what we have been able to do culturally. By contrast, in Communist countries and/or cultures, decisions have traditionally been dictatorial, and based on what has been for the good of all rather than what may be good for the individual in a competitive situation. As democratization proceeds, and it will and should, might it be difficult for these people to relate to our system, let alone be able to compete effectively? Can these people ever be expected to understand a system as complex as ours? The reason Communist systems failed is that they were contrary to the human spirit, and opposed to creative juices which flow naturally within us, including technological development. These persons are so hungry for freedoms of the market place, including purchasing and producing products of our quality and styles, that they are a force to reckon with in the world competitive market. Anyone who thinks these countries will not be competitive does not understand the realities which are currently in motion.

Democratization: Production and Consumption?
Many cultures trying to develop and democratize are primarily interested in attributes of the democratic culture for production and consumption reasons rather than for other reasons. Technology means applying techniques, resources and systems to circumstances for improvements. Our system assumes that the free enterprise market demand will provide sufficient incentive to entrepreneurs to bring forward new ideas, basically through research and development, to keep the market stimulated with new products. When this does not work, our government has traditionally pursued selected types of research and product development which are in the collective best interest but for which there may be insufficient motivation in the marketplace to pursue privately. In former Communist cultures most decisions were centrally made, as contrasted to the free enterprise system where the system is totally market driven.

It is critical that a balance be struck between the values of the cultures, and full realization granted by former communist cultures that there is more to democratization than simply producing and consumption. As we get increasingly involved in technology transfer and development it is vital that we exercise the utmost ethical and moralistic restraint, and help cultures make the decisions which are in the best interest of cultures under development, rather than decisions which are only in the best interest of our profit margins.

Major Global Technological Transfer Issues
Several major global technological issues and developments are of prime importance and will affect us for many years into the future. The best quality products today are most likely produced on a global basis with one component made in one country, another component made in a second country, and other components made in other countries. Perhaps the only common element in many modern products is that they are assembled in one location. This trend will not diminish, but will continue being stepped up in the near future.

Today's products, produced by international corporations, with plants in many parts of the world, point toward the need for technologists to be prepared to function in the development and technology transfer type environment. If a product is to be successful today it can generally not be marketed only locally or regionally, but must be marketed on a mass scale throughout the world. Democratization globally demands that these markets be opened and accessed. One of the clearest signals relating to the world view for technology today is competition. Whether the product is automobiles or food, competition is growing keener at an ever-increasing pace. As world populations become better educated and increasingly access more technological tools, their competitive abilities will be improved. Americans are being forced to become more competitive, to stay viable globally.

This all assumes we adequately understand and responsibly use development and technology transfer techniques in the future. Technology transfer is the placement of technology in a location or circumstance where it has not been prior to the transfer, and much of the transfer process relates to developing cultures throughout the world. Technological organizations are often transferred to third world cultures to take advantage of abundant/cheap labor, and to avoid industrialized governmental regulations and restrictions. The issue is how to balance the need to stay competitive and profitable without destroying third world cultures and peoples.

Some organizations attempt to protect their 'turf' from world competition and products, thinking they have improved their situation by keeping markets 'under control' and protected from 'outsiders.' Possibly in the short term they have appeared to gain, since jobs may have been kept home or local/regional materials may have been used, at least momentarily. Organizations only hurt themselves by protecting in this manner. The only way to realistically compete on a world scale is to improve quality and productivity. It is a mistake to attempt imposing unrealistic protectionist quotas, particularly in light of what we now know relative to technology transfer and development. Protectionist behaviors will only reduce
competitive edge and lead to additional job losses and work site closings locally and regionally.

More governmental and private industry leadership will be required similar to the North American Free Trade Agreement (NAFTA). This agreement seeks to set limits of production and trade, and other development and transfer related controls, between and among countries in North America. The agreement is seen as a model for future trade relationships between and among various parts of the world. In addition, international standards and operating protocols by private industry and professional groups will be required in the near future to accommodate the emerging need to develop and transfer technology. One such standard is the ISO 9000 series, a technical blueprint for setting up procedures and agreed upon documentation standards between and among suppliers and customers, regardless of geographical location and other traditional international barriers.

**Energy, Resources, Waste and Conservation.** Unfortunately, part of the technological value-set which we have engendered in our culture is waste. Virtually in every sense of the word, we are wasteful, particularly as related to production and consumption. We do not use products to their fullest potential, placing added strains on finite resources and the environment. It seems highly likely that these values will be transferred to some extent along with the intended technology and development.

As technological development and transfer processes are put in place, education about proper conservation and restoration systems for the environment must occur. Proper conservation and restoration systems should be a procedure in the sequence for preparing production, during diffusion and adoption processes, not an add-on or an after-thought just before we depart (or after departure for that matter). Conservation and restoration systems must be a value-based and overt part of production functions, similar to the way we must behave in our own culture increasingly, if we are to maintain the quality of life that all are entitled to globally.

Globally, resources are finite and they are being consumed. As residual materials in production and consumption are disposed of in land fills and dumps, waterways, or the atmosphere, the environment suffers. On-going use of technology requires resources just to keep it going. Today's products require metals and other materials composed of composites and/or difficult-to-locate resources. It is unrealistic to think that producers can function with only American resources. The world, and particularly American technological organizations' functions, are simply too complex to realistically function with only our own available resources. We must go to virtually every corner of the globe to locate necessary resources to enable our 'technological machine' to run.

Whether electricity, fuels, human input, or other energy sources as resources, some type of resources will be required for on-going uses and application of technology. As we help people around the globe and at home develop, we must recognize that this creates more demand for energy on-going. Resources, reflected in the environmental sense, are affected through technological applications. If during extraction of fuel sources, ores for metals, trees for wood, and so on, consumers and producers of technologies are irresponsible and not mindful of the future, it can have dire effects on the overall environment. Translating, increased production and consumption of products, causes increased environmental problems, similar to our own culture.

**Population.** The single most important global issue related to technology may be population, since each added mouth to feed places that much more burden on the carrying capacity of the overall system. As is clear in the Malthusian economic theory, each time the resource pie is sliced again, each person gets a slightly smaller piece of the pie. As we increase population world-wide, not only does the resource pie become smaller, but many of the related technological issues also become more intense. Demand for goods and services goes up, driving prices upward in an inflationary mode; jobs become less abundant because there are too many persons; and worst of all, the resources and environment simply can not support demands. Infrastructure is inadequate in all regards, but mostly in the areas of water and other utilities, government services, and housing shortages.

Population increases are fundamentally driven by a desire to reproduce ourselves and/or for sexual gratification. In either case, we have traditionally reproduced sufficient offspring to care for us and the farm in our old age. As we have shifted technologically, and now through development, help others shift, away from the farm and into the factory, we no longer need large families for old age and social security. Large families may actually be a burden for the technological age.

Traditionally, our culture has taught that sexual gratification for other than procreation and maintenance of the family was wrong. The family structure and broader cultural infrastructure has generally provided a safety net against frivolous procreation for reasons other than associated with family reproduction for social security. Development, pressures on the family cause a breakdown in the moral code, leading to gratification outside the family structure. When the father and mother were present in the home before development, we had control of sexual lives within the family. As persons go to work in industries we may see the breakdown of traditional family values as related to the agrarian culture.

It takes substantial education to address complex issues dealing with development and transfer of technology. As the family breakdown and changes occur...
due to development we must consider introducing contraception and other technological methods to enhance the likelihood of population control for an improved quality of life. As population expands it will grow all the faster because there are more persons to procreate. A vicious cycle becomes set in place in many developing cultures because traditional values hold that the large family is necessary and morally right. The time it takes cultures to grow double a current population, called *doubling time*, is shrinking. It is taking less and less time for the culture to expand to the point of doubling, with each doubling cycle. Mexico's doubling time fell below 20 years during the latter stages of the 20th century.

Two of the key drivers in improving our general quality of life in the American culture have been food production and medical care. As we have mechanized and industrialized, food production and medicine have generally been leading recipients of improvements and upgrades. More and better food and medical care have not only meant better quality of life, but they have also meant more people are born safely and live longer.

Improved health care and food distribution may offer the precarious opportunity for enhanced procreation, and thereby, possibilities for increased population growth in undeveloped cultures, as well. Healthier well fed people are capable of having more children and living longer. Based on problems created by over population, it may be socially irresponsible to provide undeveloped cultures with advanced food production and medical technology without also attempting to equally advance their population control techniques and technologies.

Much the same as our own culture has become educated about benefits and needs for smaller families, so can others. America has a generally flat population growth rate. There are roughly as many deaths as there are births over a time period, a situation critical to the world future. Assuming we help develop and transfer technology properly, we should be able to help reduce population growth world-wide and improve quality of living conditions for all in the process.

Some may argue that the overall approach to proliferating the use of various types of contraceptive techniques and/or technologies is morally wrong and inappropriate in transfer and development situations. This is motivated based on religious, moralistic and/or tradition views. When compared to alternatives of not using technologies to curtail population growth, it is an even greater moral dilemma. Continued unchecked growth of population can lead to overall demise of humankind. Need for education and blending traditional moral values with new technological values is critical for world order.

**Materials Environmental Concerns.** A fundamental global technological issue today is related to resources and the environment. Many technological materials appear abundantly in nature, as is the case with several metals and ceramics. Some materials will be replenished if proper planning is done, as in the case of wood and leather. It is also becoming increasingly clear that some materials are becoming in short supply. This is the case with some metals, plastics and woods.

As shortages occur, the overall quality of available materials goes down since the lowered availability of the material causes the use of some material which previously would not have been used. Increased effort must go into the extraction and refinement of the lower quality materials--and often results in spin-off chemicals and/or other materials produced as part of the harvesting/refinement process. Spin-offs are difficult to dispose of, adding to cost problems. In addition, waste materials create serious safety problems for organizations and society at large. Safety becomes an issue because materials often must be stored and transported in highly populated areas where accidents can occur.

Depletion of materials and safety must be major concerns as technologists assist in the transfer of technology to other cultures. Just as transfer of food and medical technology requires equal transfer of population control technology, materials concerns requires the transfer of recycling and conservation technology.

**Technology Assessment, Entrepreneurs, Ignorance.** Persons who provide the capital and other resources for future developments related to technology transfer and functions in various ways are called *entrepreneurs*. When persons who do not fully understand the technology, as well as related impacts and implications, move forward into development of various types, *ignorance* may be a factor. To help safeguard people and cultures from entrepreneurs lacking sufficient education, we will need independent technology *assessment* of both the technology and development projects on a global scale.

Many people world-wide wish to develop in ways such as we have in America. This zeal to move forward coupled with a general ignorance of what they are getting into could lead to unscrupulous deals being cut and many people getting hurt on a far larger scale than has ever been evidenced before. Particularly people with knowledge of technology will be needed. Persons who understand how to transfer and develop the technology, as well, will be critical to the overall mix required for the future.

**New World Order: Soul Of Technology**

The new world order is clearly based on technology. Many cultures have a rather significant distance to go to become a full participant in the new technological world order. It is pivotal to the future that
these cultures become part of that new order. If they do not, the end result may be global disharmony and substantial struggles to gain increasing amounts of the resource pie. The key for American organizations is to work within the context of technology transfer effectively to transition others from around the globe.

Far too many people will be lured by the desire for technology even though they will not truly understand it. They will move forward without anything close to a reasonable understanding of the full impact and implication for their circumstances. The race to acquire technology is driven partly out of greed, partly due to being mesmerized by the technology, and perhaps out of a desire to improve the conditions where the technology is being transferred to. Regardless of reasons, if technology is not understood, the likelihood is enhanced that the transfer and development project may not succeed.

Effective technologists know that the actual one-on-one relationships that have been built over time is what makes operations succeed. No matter what other safeguards are built in, the bottom line is how well we have done our homework on understanding the people we must work with to make the transfer and development process succeed. This is not easy where other cultures are concerned since customs and mores will vary. Knowledge of technology coupled with knowledge of culture remains a most critical element for technological transfer, regardless of culture or geographic location.

The global economy is a highly competitive environment. Competition is healthy and effective for bringing forward the best quality and productivity—up to a point. Technological development is related to gaining a larger piece of the economic pie. Not everyone may feel positive about a few becoming more successful. When we lose site of the goal of enhancing the lives of ourselves and others through technological development, we find ourselves in a highly precarious position.

Successful technology transfer and development projects will be handled so that these sensitivities will not become an issue. If and when enough people in a culture get upset about any technological development, resource, and/or environment issues, hostilities or even war may develop. This is not a goal of those who want to transfer technology for improvement of the human condition.

Ignoring transfer and development issues will not work, either. Global communications and transportation connect us all to better see how others are living. Much of the world will not only seek a lifestyle and levels of technological functioning similar to our own, but they will expect and demand it. Either we work together to achieve peaceful transfer of a technological lifestyle, or we will have aggressors pursuing the same objectives.

Technology, Spiritual Balance and World Social Responsibility. Much about our culture is based on religious and spiritual mores and values for living. Regardless of how this is interpreted by the individual, we have tended to believe as a culture that things will get better. We have also believed that we have a responsibility to try to improve things and conditions in our own lives and those around us, in the form of culture. This is part of how we have gotten to where we are. The struggle to move forward has resulted in using our native intelligence and other resources to shape them into various technological functions. We have a social and moral responsibility to share what we know and have with others, both domestically and abroad, to help improve.

A balance must be aspired for and achieved to enjoy successful development and technology transfer, and certainly the good life. This balance is thought to involve the coupling of spiritual and religious aspects of culture with the technology. We know there is more to life than just the technological, and that the good life requires keeping a healthy spiritual perspective along with a technological perspective. Balance goes well beyond only infrastructure and production aspects of culture, respecting the environment, and reducing wanton destruction of forests and mineral deposit sites for a quick return on investment. We must help persons understand the need for population control through technological methods in the interest of reducing demands on global resources by having fewer persons to care for.

Virtually everything about our religious and spiritual psyche also relates to the way we approach our technological affairs. This connection and balance is strong, real, and essential. Were it not for this strength and balance we could all simply be robots and more efficiently go about our affairs as pieces of technology. This psyche must be carefully and methodically transferred with all technology for development if we are to truly be successful in establishing a new technological world order for the future. Ignoring the need to take a proactive role in shaping the new technological world order could be catastrophic if mishandled.

Soul Of Technology, Ongoing Improvement, Change. Soul is intended to heighten spiritual aspects of technology, and in the process help us see further what technology is about. Soul of technology says there is a spiritual side of technology, an element of going beyond the physical presence of the technology we see, and providing longer term and deeper impacts and implications. Soul is further defined from the perspective of spiritual aspects, physical and historical presence, extending human dimensions, pushing the envelope for excellence, and, team synergy for improvement.

Spiritual aspects. The word spiritual has to do with spirit. Spirit, as a function of soul of technology suggests that there is something more at work through technology than necessarily meets the eye. This may be
true when technology defies basic laws of physics, does more than it was designed to do, or simply helps people accomplish more than would seem logical and reasonable under normal circumstances. Spirit may also be evident in technology when people are motivated through emotional forces of the technology. When we go above and beyond the norm, accomplish more than was required, due in part to the technology, perhaps this qualifies as spiritual aspects of technology.

**Physical and historical presence.** Few will doubt the physical presence of technology. But as people who created the technology originally, or had a hand in the creation and development of technology, move on or pass on over the years, what is it about technology that continues to pass along its presence. The defining elements of technology over time will be referred to as soul for purposes of this discussion. This is thought to be true in regard to good architecture, structural design in devices and systems, actual assemblies of product and systems, and so on, all physically present well beyond the person who gave birth to them.

**Extending human dimensions.** Well beyond what one individual can do, or the impact which we can have, the technology extends our capacity for accomplishment. This we define as soul, since it embodies our design and system for addressing issues and circumstances at hand. At least in part, then, we can say the soul of technology is that which we have the capacity to accomplish based on human inputs per the design, selection of components, materials, processes, and so on. This extended human dimension is true over both time, as well as distance, and perhaps in other ways which allows us to go beyond the human physical limitations which appear quite naturally. Technology provides a capacity to do "supernatural" acts which, if left to our individual human physical prowess, may be less accomplishable.

**Pushing the envelope for excellence.** One additional important facet to the soul of technology is the emotional and attitudinal "stretch" which technology affords toward standards of excellence. As people become aware of technological opportunities, and as they are brought up to speed regarding its use, generally the quality standards are enhanced. If this were not true, how else could we account for the general rising of quality of life standards which we have all become so accustomed to? Why else would we use indoor plumbing rather than the outside privy, eat canned pre-cooked vegetables rather than hunting and gathering raw vegetables, drive our vehicles rather than walking, and so on? This also explains a desire of many cultures, other than our own, to be like us. We, in large part due to our technological standards of excellence, have provided the level to be striven for by others. This, again, is defined as the soul of technology, providing a hopeful and optimistic attitude for all who aspire to do more and better than others may have been able to do. This also explains our desire to improve ongoing, as well as our ability to do it creatively.

**Team synergy and organizational improvement.** When we get caught up in technological functions, new product development, designing the latest concept, bringing the new idea to fruition, or simply figuring out a better way to do something, this is improvement as defined in the soul of technology. The soul also speaks to technology's capacity to engage entire teams of individuals, instilling a spirit of direction and desire to address deliverables in a cohesive and appropriate manner. Part of the synergistic effect is actually soul emanating from the technology, and multiplied through the group effect. When the entire organization is brought into the technological fold through training and the broader change process, we would say the organization has a "soul of its own". The organization fully energized by technology, undergoing systematic and planned change, will extend its presence, or soul, in the future in ways which assure competitiveness, short and long term.