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Financing Cassava Processing Among Women In Rural Nigeria To Alleviate Poverty: - The Place of Self-Help Groups

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Abstract: This paper examined the place of self-help groups in financing cassava processing among rural women in Nigeria. One hundred and twenty (120) cassava processors were selected from three (3) geo-political zones out of the six (6) geo-political zones in Nigeria through simple random sampling technique. Four (4) states were selected from each of the three (3) geo-political zones and ten (10) respondents were selected from each state. Results show that self-help groups play major roles in financing cassava processing. Areas of finance involve mobilization of funds for financing rural development projects, construction of roads and bridges to facilitate the transportation of cassava produce to the urban centres, improvement of the economic status of cassava processors, increase productivity of cassava processors putting their resources together in form of labour, capital management and provision of loans. Identified Self-help groups include "Esusu" groups, Family / Kith and Kin meetings, informal cooperative, group farming societies, social clubs, and church groups. It is concluded that government and non-governmental organisations should help to finance cassava processors in rural Nigeria to enhance their income. It is however recommended that Non-governmental organizations as well as church groups should also support the poor in building strong self-help groups rather than providing only welfare support services. They should tap the potential of "Esusu" groups as income producing groups and human labour force.

Introduction

In the last two decades, a lot of attention has been drawn to the important role of rural women to agricultural production in developing countries, especially, Nigeria. However, prior to the realisation that rural women constitute, an "economically active population, they were largely not considered productive because they usually worked as unpaid family labour (Olawoye, 1998). They therefore, need to be empowered economically to improve the standard of living of rural household for enhanced food security in Nigeria. Successful financial outreach to the rural poor requires institutional innovations that reduce the risks and costs of lending small amounts of money. Hence, for poor rural families in developing countries, especially in Nigeria, access to credit and saving facilities such as banks has the potential to alleviate poverty and make economically secured life.

It is therefore, important to set up well-managed savings facilities that will permit rural households to build funds for future investments and/ or consumption. This will help in alleviating poverty among rural households. This paper therefore focussed on financing cassava processing among women in rural Nigeria to alleviate poverty through self-help groups.

Role of Self –Help Credit Groups in Poverty Alleviation

Poverty is the state of deprivation of fundamental human needs and desire. This involves the desire for sufficient food and water, adequate shelter, good health, long life, education and the capacity to provide materially for oneself and family through productive ventures. A major constraint of farmers in

Nigeria is how to obtain credit from formal financial institutions such as banks for farm operations. Unavailability of credit from financial organisations in Nigeria has resulted into the use of financial self –help groups to alleviate their sufferings in meeting financial needs. In some communities in Nigeria, individuals of the same age group or same family lineage or affiliations exchange labour with each other in farming, building houses, constructing roads, harvesting and processing farm produce and solving some other socio-economic problems. Self-Help groups in Nigeria help in providing credit facilities to members and non-members at different interest rates and assist in providing mutual aids. This enables members to feed themselves thus alleviating poverty. Farmers join hands with each other to work on individual farms and family circles to aid and assist in food production and provide financial and other resources needed for sustainability. Small-scale industries are set up or established through small credit and savings with liberal credit policy.

The task of providing credits and savings opportunities at a reasonable cost to those who have only meagre assets have been neither straightforward nor easy in Nigeria. In Malawi, Ghana, and Pakistan, access to credit and savings facilities is severely limited for small farmers, tenants, and entrepreneurs, particularly women (Enabulele, 2001) In many countries (including Nigeria) only few of the loan applicants can borrow an adequate amount at the growing interest rate, either from formal institutions such as banks and cooperatives or from the informal sector- friends, relatives, and moneylenders. Many potential borrowers are in need of credit that they are willing to pay substantially higher interest rates in the informal markets. Sometimes as high as 80percent per year.. It is, therefore, very clear that the task of delivering financial services to the rural poor cannot be left entirely to market forces. It is therefore, important to promote linkage of these self-help groups to the banks since the problems of the informal sources can be reduced through this linkage to the banks. Promotion of the self-help groups formation among rural women will help to provide a framework for permanent business relations between rural dwellers and banks directly; recycle locally generated funds within the rural areas; generate credit guarantee; mobilise institutional resources; facilitate savings deposits; provide credit delivery channels and reduce transaction. Finally, self-help groups are useful institutions for poverty alleviation and there is the need to standardise their operations and enhance their financial strength since it is a veritable tool for alleviating poverty.

The Role of Self-Help Groups in Alleviating Rural Poverty

Both formal and informal associations have complementary roles to play in fighting poverty and in promoting development in rural areas. According to United Nations Report (1982), most non-governmental organisations (NGOS) have roots in local areas or strong localities. These associations undertake activities designed to enhance self-reliance and self-help thereby fostering participation and the development of local institutions. One of the major problems of an average Nigerian farmer is how to obtain credit from formal financial institutions. The unavailability of this credit from the formal financial institutions has prompted most farmers in the rural communities to organise themselves into financial self-help groups in order to meet their financial and social needs (Enabulele et al; 1999). In most rural areas all over the world, self-help organisations are proliferating in response to increasing economic hardship. In Nigeria for example, self-help organisations in Obusa in Benue State have been found to construct roads, act as a thrift and credit association, procure farm inputs for their members and organise collectively supplied labour on the farms of their members (Todd, 1995). They also care for the sick and bury the dead and maintain law and order in the community.

Methodology

120 registered cassava processors from Agricultural Development Programme blocks were randomly selected from three, out of the six geo-political zones of Nigeria. These were considered to be representatives of the zones as shown below.

Table 1.0 Distribution of Respondents According to Geo-political Zones

Geo-political Zone	States Included in zone	States Selected for the study	No of Responded
Southwest	Lagos, Ogun, Oyo, Osun, Ekiti, Ondo.	Oyo, Ogun, Ondo Lagos	10 from each state (40)
South-South	Delta, Bayelsa, Edo ,Rivers, Akwa-Ibom, Cross River	Delta, Akwa-Ibom, Cross River, Bayelsa	10 from each state (40)
Southeast	Imo, Anambra, Enugu, Abia, Ebonyi	Ebonyi, Abia, Enugu, Imo	10 from each state (40)

Structured Interview Schedule were administered to one hundred and twenty registered cassava processors selected from all the twelve states. Questions on financing Information was obtained on personal characteristics of the cassava processors, source of inputs, Sources of Labour, Mode of sale of cassava products, means of marketing of cassava products, sources of credit, crops processed by respondents, membership of self-help groups, and problem encountered by respondents belonging to Self-Help groups and the role of Self-Help groups in poverty alleviation. Qualitative method of data analysis such as focus group discussion and in-depth interview (IDI) schedule were used to analyse the data collected.

Results and Discussion

The results of the data are revealed below:

Table 2.0 Distribution of Respondents According to Social- Economic Characteristics

Age[in years]	Frequency	Percentage
< 25	10	8.0
26-30	12	10.0
31-40	42	35.0
41-50	23	19.0
>50	33	28.0
TOTAL	**120**	**100.0**
Level of Education		
Non-formal Education	21	18.0
Completed Primary School	18	15.0
Did not Complete Primary School	55	46.0
Did not Complete Secondary Education	16	13.0
Adult Education	1	01.0
TOTAL	**120**	**100.0**
Household size		
<2	1	1.0
2-5	29	24.0
6-10	78	65.0
11-15	8	7.0
>15	4	4.0
TOTAL	**120**	**100.0**
Marital Status		
Single	7	5.0
Married	111	94.0
Divorced	2	1.0
TOTAL	**120**	**100.0**

Survey Data 2004

Under this section, fifty four percent (54%) of household heads fall within the age range of 31-50 years. This age range can be regarded as the youthful age when they can make vital impact in agricultural production in particular (Table 2.0a) Most (61%) of the cassava processors have received only primary education while 15percent completed primary school, 18percent did not receive any formal education while 13percent received secondary school education . Seventy out of one hundred and twelve cassava processors have received only primary education. The level of education attained would affect their innovativeness, rate of adoption of new technologies and productivity (Table1.0b) Seventy out of one hundred and twelve cassava processors indicated their household size to fall between six and ten. As the house increases to more than people, the percentage of respondents decreases toll. This finding tallies with research work by Narayan and Nyamwaya (1996) in Kenya. They found out of that poverty was linked with large families land fragmentation, which resulted to smaller plots and lower yields. Furthermore, many children and dependents implied more mouths to feed.

Sources of Labour: The amount of Women's labour on the farm was assessed during the study. Activities (tasks) for which labour is needed include peeling, grating, sieving, dewatering, and frying. Any arrangement aimed at improving farm efficiency should pay particular attention to labour use for cassava processing operations. In order to cope with the cassava processing activities, 41 percent of cassava processors use their children as their source of labour on the farm. This probably accounts for the large household sizes found in rural households. This finding is in line with that reported in African Development. Review Reports (1991), which states that the low productivity of labour in agriculture has resulted in the demand for children as a means of increasing the labour supply in farming. This implies

that the cassava processing operations (stapes) is labour demanding and if labour supply is not enough, it could constitute major bottlenecks and strain on farm labour supply.

Means of Marketing Cassava Processed Products: Most (50%) of the cassava processors sell their produce to traders white 20percent of them sell their produce through cooperative societies.

Sources of Information: The major sources of information stated by the respondent include self-help groups and social clubs (52%) Extension agents (22%) and radio (13%),such information include the use of improved processing technologies.

Source of Credit: 34 percent of credit comes from voluntary associations, self-help groups, multipurpose cooperative societies, credit and thrift societies. Personal savings, friends, family members and husbands contribute 27,3,4 and 5 percent respectively. Only 7% of respondents have access to credit through banks. This finding is similar to that of Oladosu et al (1999) They found out that non-institutional financial sources such as informal cooperative thrift societies, friends and relatives constitute the main source of credit to rural farmers..

Cassava Products Processed By Respondents

93% of the cassava processors process cassava tuber into forms that can carry them into periods of scarcity. Only 7% of the respondent did not indicate processing their produce other products include ``Gari", Cassava flour, Cassava starch, ``fufu". These processed forms according to them can last for weeks against lean periods.

Means of Transportation

Majority (20%) of the respondents trek long distances due to bad roads. Only 19% of households use motorcars as a means of transportation probably due to high transportation cost and unmotorable roads.

Membership of self-help Groups

Seventy –nine percent of households belong to a minimum of one and a maximum of three self-help groups. Fifty – on percent of the respondent indicated belonging to 3 self-help groups. Ten percent of the respondents belong to five voluntary associations.

Roles of self-help groups to Rural Development

The role of self-help groups indicated by the cassava processors include mobilization of funds for financing some rural development projects, construction of roads and bridges to facilitate the transportation of farm produce to the urban centres improvement of the economic status of their members, increasing the productivity of processors by putting their resources together in form of labour, capital management and loans used in the purchase of farm inputs by members. All these help in improving their standard of living. The profit margins are increased and improved through the self-help groups' membership. This is achieved through activities such as production, marketing of agricultural produce, credit mobilization and processing of farm produce. These activities help to cut-off the interference of middlemen and improve the profit margins of their members hence an increase in their standard of living. Other roles of self –help groups mentioned by respondents include capital formation, source of education, source of unity, peace and stability, provision of social insurance and health care services, provision of land members, and source of labour.

Participation in Social Groups and Associations

A variety of self-help groups and association with varying degree of formality, exist in the localities studied. The social capital that local inhabitants often rely upon in cases of difficulty or when formal services are lacking, or fail to deliver, these existing groups can perform important functions as channel of development interventions. In some cases, they may require capacity building to enhance effectiveness. Table 3.0 Age grades and town development unions are quite frequent in south and southeast states but less prevalent in the use. Result of the focus group southwest discussion and in depth interview help with the women cassava processors in the study area. Table2.0 shows the part played by financial institutions or voluntary associations in alleviating poverty in the study through oral interview with four women leaders from 4 agro-ecological zones and 4 women focus groups consisting of cassava women processors from each agro-ecological zone. Below is the summary of the Name of the financial Institutions/self-Help groups in the Study area.

Table 2.0: Distribution of Respondents According to Types and their Roles in Self-help groups.

Name of financial Institution Self-Help group	Roles
"Esusu" groups	▪ Provision of credit facilities to members ▪ Provision of education to members ▪ Ensures the welfare of members ▪ Provision of social insurance services such as medical treatment
Multi-purpose Cooperative Societies	▪ Provision of loan ▪ Ensures the marketing of agricultural produce ▪ Provision of Land on-lease to members
Family / Kith and Kin meetings	▪ Ensures the Welfare of members for example hospitals bills, medical treatment, etc. ▪ Provision of financial support in times of emergencies such as funerals, marriages etc. ▪ Provision of joint labouring farming
Informal Cooperative group farming societies	▪ Provision of land on-lease ▪ Provision of labour for farm operations ▪ Provision of Capital to aid farming activities ▪ Management of agricultural resources to increase productivity
Social Clubs	▪ Provision of labour in rural development projects such as road construction, road maintenance, building of bridges etc.
Church Groups	▪ Provision of social welfare services to members such as health care services. ▪ Provision of financial support to members in times of emergencies, payment of hospital bills, medical treatment etc.

Survey Data (2004)

Age grade and town development unions are quite common in the Study area.

The commonly reported benefits from membership in different groups are cited in the following table.

Table 4.0- Distribution of Respondents based on the derived Benefits from Organisations and Associations.

Type of Organisation	Commonly cited Benefits to Members
Cooperative	Loan / Security; Credit services; promote savings; helps farmers
Savings and Credit	Loan / Security / Financial Support / Credit; promotes savings.
Informal Work Exchange	Provides labour; helps farmers
Age Grades	Social activities; Community development; increases motivation
Town Development Union	Social activities; Community development; settles disputes
Religious Groups	Peace / Spiritual growth / Prayer; Moral support; social activities.
Others	Various benefits depending on type of group

Implications for Poverty Alleviation

The constraints of self-help group cassava processors among others include cost and access to loanable fund. This can be solved through the self-help groups. This will improve or alleviate the poverty of members and non-members alike. Enlightenment programme through mass campaigns, seminars, lectures, workshops etc. on the potential of self-help groups in alleviating poverty and dissemination of information on the formation and benefits of self-help groups in rural communities of Nigeria are all important for improving the standard of living of members in the rural areas. Good government policy that will encourage the formation of viable self-help-groups in Nigeria should be encouraged. Formation of Farmers' cooperatives should be encouraged to help farmers overcome their individual problems.

There is the need for non-governmental organizations to cooperate with each other in order to ensure effective supply of services while avoiding duplication of services. It is also important that these organizations be affiliated with banks, and other financial; institutions to avoid breakdown as a result of absence of timely support from outside and inability to meet the needs of their potential clients. Non-governmental organizations as well as church groups, should support the poor in building strong self-help groups rather than improving their welfare support. They should tap the potential of "Esusu" groups as income producing groups and human labour force.

Conclusion

The major conclusion of this paper is that the Self-Help groups play major roles in alleviating poverty among cassava processors in Rural Nigeria. However, the self-help groups play major roles in addressing and solving the problem of women cassava processors in Nigeria. The roles of self-help groups identified by the cassava processors include the development of rural development projects, construction of roads and bridges for easy transportation from villages to the market centres, provision of labour, capital in form of loans for the purchase of farm inputs. It is therefore, recommended that the efforts of Self-help groups be complimented with the formal financial Institutions and the government. All these will alleviate poverty and improve the standard of living of women cassava processors.

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Effect of Questionnaire, Cover Letter, and Follow-up on Non-Response Rate in an E-Mail Assisted Internet Survey in Pakistan

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Introduction

Survey non response has always been a teasing research concern due to its implications for reliability, validity, generalizability, and replicability of the findings and Internet surveys are no exceptions (see e.g. Best et al. 2000; Braithwaite et al. 2003; Cook and Thompson 2003; Kypri and Gallagher 2003; Schaefer and Dillman 1998). Internet surveys are fairly popular in developed countries for a verity of research purposes, and in variety of fields, ranging from healthcare, to social behaviour to tourism (Bayliss et al. 2003; Best et al. 2001; Hwang and Fesenmaier 2004; Im and Chee 2005; Schleyer and Forrest 2000). This is particularly so if the survey universe has access to e-mail (Berrens et al. 2003). Even when the entire universe does not have access to e-mail, multimode approach is fairly successful in gaining high response rates (Schaefer and Dillman 1998). With increasing access to Internet and e-mail by various groups in Pakistan, research questions concerning Internet-based surveys are of paramount relevance. In Pakistan, the research culture, however, is close to being absent in social science disciplines (Shah, Qureshi, and Abdul-Ghaffar 2005). Consequently, common people do not understand the importance of research. Besides, response rate in Internet surveys tend to be generally lower than equivalent mail surveys, unless rigorous follow ups are conducted (Cooper, Blair and Triplett 1999; Sheehan 2001). This may be due to lack of understanding in research community on how to achieve high response rates using the Internet surveys. Given this scenario, understanding factors associated with non response in e-mail assisted Internet surveys of Pakistan is important. Our study investigates the effect of nature of the subject matter being studied, font color of questionnaire, follow up letter, and presence of cover letter on the non-response rate in e-mail assisted Internet based survey of a closed sample of respondents. Although non-response rate in internet surveys has been a subject of investigation elsewhere (Trouteaud 2004), to our knowledge no published study addressing Internet survey non-response rate variation or its correlates exists in Pakistan. This signifies a strong justification for and strength of our study.

Literature Review

For years, traditional paper and pencil assisted questionnaire-based face to face surveys have been used for data collection in all social sciences (Dillman 1998). After increasing availability PCs in 1980s and that of Internet in 1990s, Internet surveys have gained popularity in research (Bets et al. 2001;

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Shannon, et al 2001; Zhang 2000). This is evident from a growing number of electronically administered surveys over the past several years (Braithwaite 2003; Solomom 2001; Zhang 2000). Potential of the Internet surveys as a viable research tool has been demonstrated empirically (Mertler 2002). Internet survey technique has been found to be a highly promising method for data collection, due primarily to their functionality (Dillman 1998; Schilleweart, Langerale, and Duhamel 1998). Internet survey must somehow be publicized. Merely making a questionnaire available online may not suffice. Some mechanism must be used to direct potential respondents to the actual URL containing the survey, either by providing a link to the URL in an email message or by providing the URL in a cover letter (Shannon et al. 2001). Variations exist in the way Internet surveys are conducted (Dillman 2000; Eysenbach and Wyatt 2002). After posting the questions on the internet, the sampled respondents are sent an email request to complete the questionnaires. Such requests are also sent by phone, regular mail and through other modes (Berrens et al. 2003; Schaefer and Dillman 1998). Interactive Internet surveys can be conducted by means of interactive interviews as well (Eysenbach and Wyatt 2002). If the concern is to control the target population, sampled respondents can be sent a username and password. However this may lead to lower response rate (Fischbacher et al. 2000). In some situations, questions are posted on an Internet site, and no separate requests are sent to respondents. For instance, Braithwaite's review of 17 Internet-based survey studies revealed that some of those studies drew on unknown denominator populations by placing survey questionnaires on open web sites. In another Internet survey of public knowledge about tuberculosis, four simple multiple-choice questions about tuberculosis were posted on a non-medical internet site for a 2-month period, assuming that all internet users constituted the sampling frame (Corless et al. 2002).

Advantages and disadvantages of Internet surveys

Internet Surveys offer several advantages and limitations, when compared with other modes of survey research. However researchers have come to a conclusion that Internet-based surveys provide an attractive alternative to postal and telephone surveys (Braithwaite 2003). Evidence has emerged showing that use of the Internet for conducting survey research as a mode of data collection has gained increasing popularity in recent years (Kim and Hoy 1999). This is due primarily to multitude of advantages associated with it, including its flexibility in allowing complex questionnaires to be administered more quickly, and inexpensively than conventional survey methods (Best et al. 2001). Time: E-mail surveys are particularly useful if rapid response time is desired (McMahon et al. 2003). The time needed to collect data is relatively short. They are found to be faster than mail and other survey modes. However, Internet surveys data collection time frame may need to be left open for a considerable time, spanning from 10 days to few months, in order to achieve an acceptable response rate (Murray 1995; Truell, Bartlett and Alexander 2002). Completion: Internet surveys are more effective in terms of completeness, lowering the risk of item non-response (Truell, Bartlett and Alexander 2002). For instance, McMahon et al. (2003), observed that completion rate was better and the item non-response rate was lower in the electronic surveys (Internet/email) when compared with postal or fax participants. For this to happen, availability of updated e-mail addresses is important. In the meantime, mixed-mode surveys may be an option. (McMahon et al. 2003). Cost: In addition to being expedient and having better completion rates, Internet surveys are advantageous when cost is a concern in that they can be conducted at a low marginal cost per completed response (Berrens et al. 2003; Schillewaert et al. 1998; Solomon 2001). Costs of Internet surveys are low to moderate. They are cheaper than even the phone surveys (Murray 1995). In their study, Schleyer and Forrest, (2000) found that the cost of the Web-based survey was 38 percent less than that of an equivalent mail survey. Amount of Information: Longer Questionnaires are a problem in many forms of surveys, particularly the telephone surveys (Dillman 2000). Internet surveys are capable for providing large quantities of information (Berrens et al. 2003), as questionnaires of moderate length can be administered (Truell, Bartlett and Alexander 2002), Response Rate: A reasonable rate of response can be expected in most well planned Internet surveys. Internet surveys are effective in obtaining high response rate when coupled with intensive follow-up (Kypri and Gallagher 2003). Saphore (1999) found

that there were no differences in the pattern of responses between an Internet survey and an identical pencil-paper form of the same survey. Although earlier studies found that response rate of their electronic surveys were comparable with postal mail response rates and that the gap was narrowing between e-mail and traditional mail techniques (Mehta and Sivadas 1995), there is some evidence that there has been gradual decline in response rate of e-mail surveys (Shehaan 2001). In addition, Internet surveys are characterized by protection against the loss of data, easy transfer of data into a database for analysis, convenience for the respondent, the possibility of wider geographic coverage (Carbonaro & Bainbridge 2000; Mertler 2002; Shannon et al. 2001; Schillewaert et al. 1998). Like other self administered surveys, Internet surveys eliminate the chance of interviewers' bias (Berrens et al. 2003). Visual aids, in the form of graphics and pictures, are available in Internet surveys that are not for instance available in telephone surveys. Internet surveys can be designed to make them more inviting and attractive (Schillewaert, Langerak and Duhamel 1998). Consequently, the order of the questions can be controlled better, and skip patterns can be programmed effectively.

Limitations

Among the disadvantages and limitations of the Internet Surveys, representativeness, quality, and data quality are obvious. Data quality, in such surveys may be low because there is generally no way to provide clarifications for questions and probe for responses, a classical problem with paper-based mail surveys as well. As in mail surveys, Internet surveys can only be administered among respondents with ability to use computers and read. Credibility of responses in internet may be of question if the credentials cannot be verified (Smith 1997).

Representativeness: Open web-based surveys are vulnerable to selection bias because of the non-representative nature of the population. The so called "volunteer effect" can be an additional source of error as a result of self-selection of participants (Eysenbach and Wyatt 2002; Taylor 2000).

Internet Survey users confront the lack of representativeness both in terms of coverage of the population and capabilities for drawing random samples (Berrens et al. 2003). This is among most important of the limitations of web-based surveys. Internet access is restricted to individuals with access to computer networks. Thus, drawing causal inferences to the general population from analyses of internet may only be appropriate if the decision-making processes of Internet users can be assumed to be similar to those used by the general population. In addition, drawing a representative samples of Internet users may not be possible (Best et al. 2001) Due primarily to coverage error, Internet-based sampling procedures may be open to a substantial potential for bias (Hwang and Fesenmaier 2004). However, by blending the principles of a controlled mail survey with data collection through a Web-based database application in a survey, better response rates and accurate estimation of parameters can be achieved. Schleyer and Forrest (2000), for instance, employed this principal in implementing their survey as a series of simple HTML pages and obtained a response rate of 74.2 percent. Survey research professionals have suggested that Internet surveys be used primarily with specifically identifiable samples such as "in-house" employee groups (Shannon et al. 2001). Alternatively, Taylor (2000) has suggested that we should do data interpretation keeping in mind that online data collection is not based on probability sampling, but rather on "volunteer" or "convenience" sampling. Email surveys have some additional limitations. First, unsolicited e-mails are considered aggressive and non-serious, and e-mail addresses change frequently (Sheehan and Hoy 1999). Secondly, researcher may not have control over fake e-mails and others can fill in questionnaires for the selected respondents (Smith 1997; Fischbacher et al. 2000). In addition, software required for setting up a web-based survey and the programmer's time may add to the Internet survey cost (Fischbacher et al. 2000). Other problems included incompatibilities/technical problems, usability problems, and a programming error. (Schleyer and Forrest 2000). Further, unavailability of population lists, computer access to the survey, and lack of technological familiarity on the part of respondents, inability to identify potential respondents, and browser incompatibility problems are among other difficulties associated with Internet and email surveys (Carbonaro & Bainbridge 2000; Schillewaert et al.

1998; Shannon et al. 2001; Solomon 2001). Some of these limitations can be overcome by taking certain practical steps. First, access to the survey must be as simple as possible for all respondents. The more complex the process of completing the survey, the lower the resultant response rate will undoubtedly be. Second, the process must be designed such that respondents of the Internet survey are able to complete it with the same relative ease as if they had received a traditional paper version. Third, some sort of security system is required, in order to maintain the integrity of the data, but also to put at ease the mind of the respondent. Finally, completion of the survey must require only minimal computer skills, including the ability to use an Internet browser, enter a specific URL, use a mouse, and type on a word processor (Carbonaro and Bainbridge 2000).

Methodology

The research design for this study is an Internet survey of NGO employees, through e-mail. There are several ways to conduct internet-based surveys. For instance, one can assemble a large panel of willing respondents who can be sampled. Another strategy, is to use random digit dialing (RDD) telephone methods to recruit households respondents (Berrens et al. 2003). Sheehan and Hoy (1999) believe that using e-mail to survey internet respondents is pretty successful way to conduct internet surveys. The current study used e-mail to implement the Internet survey. The sampling frame was obtained from Aga Khan Research Institute, Karachi, Pakistan, consisting of fairly complete list of NGOs operating in all four provinces of Pakistan. Using the two stage probability sampling, a total of 1600 NGO employees were selected for this study. At the first stage of sampling, 125 NGO's were randomly selected as the primary sampling units (PSUs) from the list of 600 NGO's all over Pakistan. At the second stage, all employees with a valid email address from these selected NGO's were chosen to constitute the final sample 1600 NGO employees.

The pre-constructed survey instruments consisted of four different questionnaires, relating to four types of issues:

Restoration of Pakistan's conditional membership of commonwealth (political issue)

Drug addiction (social issue)

System of education in Pakistan (educational)

Terrorism (national and international issue).

The four questionnaires containing questions on four different issues were designed on Macro Media with and without color effect and with and without cover letter. Another variable introduced to the study was follow-up (or no follow-up). Thus a total of four different correlates of the dichotomous variable non response were examined in this study. They were: (a) Nature of the subject matter being studied, (b) color of questionnaire, (c) follow up letter, and (c) presence of cover letter. Combination of issue type (subject matter) and two other dichotomous correlates of non-response (font color and cover letter) lead to 16 different variations. Respondents in each of theses variations were sent 100 questionnaires, as shown in Table 1.

Table 1: Distribution of respondents, by type of questionnaire, color of questionnaires' font and presence of the cover letter.

Type of Issue or Subject matter	Whether the colored font was used in the questionnaire				Total
	Yes		No		
	Whether a cover letter was sent		Whether a cover letter was sent		
	Yes	No	Yes	No	
Education System	100	100	100	100	400
Commonwealth membership	100	100	100	100	400
Drug Addiction	100	100	100	100	400
Terrorism	100	100	100	100	400
Total	400	400	400	400	1600

All of these 16 categories were exposed to the third variation; they were examined for non-response rate pre-and-post follow up. Although several follow ups could have been conducted, only one email follow up was conducted in this study. As shown in Table 1, 800 questionnaires had a colored font as opposed to another 800 with black font. Four different colors were used (for no particular reason) for different issue types. For the questionnaire on restoration of Pakistan's conditional membership of commonwealth, font color was purple. For the system of education in Pakistan, the font color was green. For the questionnaire on drug addiction, and terrorism, the font colors were, respectively, orange and blue. Questionnaires of all four types were pre-tested during the pilot phase of the study. Questionnaires were made available online and an email message containing the URL of the questionnaire was sent to potential respondents, inviting them to complete the questionnaires. Completed questionnaires (as html form) were submitted online by the respondents. Thus the data collection was done through internet during the seven month period of February through August 2004, with an overall response rate of 28%.

Using SPSS Version 10.0 as the analysis tools, descriptive as well as inferential statistics were computed to test the hypotheses. Non-parametric tests, Chi-square and its variations such as Phi and Cramer's V were used to test the significance of association between the dichotomous dependent variable non-response and categorical independent variables, such as font color of the questionnaire, presence of cover letter, and type of issues central to the questionnaire. The chi-square test is widely used as a non-parametric test to determine whether the difference between the observed and expected frequencies of two categorical variables is due to chance alone or is the difference is statistically significant. (Agressti 1996). It is a very simple test, which has many applications in situations that involve the testing of hypothesis concerning qualitative or discrete data (Stokes, Davis and Koch. 2001; Hollander and Wolfe 1999). Chi-square The availability of computer based statistical packages such as SAS and SPSS has made analyses of data and computation of test statistics such as Chi-square easy (Higgins 2004). However, for manual computations, the following formula is used for obtaining the value of chi-square:

$$\chi^2 = \sum_{i=1}^{n} \frac{(o_i - e_i)^2}{e_i}$$

Where 'o' stands for observed frequency; and 'e' stands for expected frequency for various response categories of the variables used to compute contingency tables. Phi and Cramer's V were also computed for the test of significance, which are chi-square based measure of association.

Phi = SQRT (χ^2/n).

Cramer's V is the most popular of the chi-square-based measures of nominal association because it gives good interpretation about the strength of association from 0 to 1 regardless of table size, when row marginal are equal to column marginal. V equals the square root of chi-square divided by sample size, n, times m, which is the smaller of (rows - 1) or (columns - 1).

$V = SQRT (\chi^2/nm)$.

In addition to the above, odds ratios, a basic parameter for logit and probit models were also used. The odds of a success are defined as a quotient of the division of success by the probability of failure. The odds are non negative, with value greater than 1.0 when a success is more likely than a failure and with value less than 1.0 when a failure is more likely than a success. For example when odds = 4.0, a success is four times as likely as a failure i.e. we than expect to observe four successes for every one failure. When odd = ¼, a failure is four times as likely as a success i.e. we expect to observe one success for every four failures. The odds ratio can be any non-negative number i.e. $0 < OR < \infty$. The value of OR = 1.0, corresponding to the independence of two variables, serves as a baseline for comparison. Odds ratio on each side of 1.0 reflect certain types of association. The highest non response rate was

Results

The overall response rate in our study was 28%. The response rate of Internet studies vary greatly. For instance Braithwaite and colleagues (2003) observed that the response rates in Internet studies review by them ranged from nine to 94%. They noted that sending follow-up reminders resulted in a substantial increase in response rates. Our analysis show that response rate varied substantially across four type of issues or subject matter studied in the survey, namely, Pakistan's Education System, restoration of Pakistan's Commonwealth membership, drug addiction, and terrorism as both national and international issue. The highest non-response rate of 82.50% was observed when the issue of questionnaire's focus was restoration of Pakistan's conditional membership of commonwealth, a political issue (Table 2). The lowest non-response rate of 53.62% (and hence the highest response rate) was observed in case of questionnaire on terrorism, which has been an issue of greater interest after recent surges of national and international terrorism. The non response rate for the other two issues, namely, Pakistan's Education System, and drug addiction was respectively 77.87%, and 74.37%.

Table 2: Non-response rate and test of significance using Chi-square, by subject matter, questionnaire attribute and follow up

Independent Variable	Type of Issue or subject matter covered in the questionnaire			
	Education System	Commonwealth membership	Drug Addiction	Terrorism
Font color	(P = 0.000)	(P = 0.016)	(P = 0.224)	(P = 1.000)
Black	86.75%	85.75%	72.50%	53.00%
Colored	69.00%	79.25%	76.25%	53.00%
Cover letter	(P = 0.740)	(P = 0.000)	(P = 0.224)	(P = 0.000)
Not sent	75.25%	89.75%	76.25%	63.00%
Sent	80.50%	75.25%	72.50%	43.00%
Follow up	(P = 0.000)	(P = 0.000)	(P = 0.000)	(P = 0.000)
No Follow up	86.75%	88.75%	83.25%	67.75%
Follow up	69.00%	76.25%	65.50%	38.25%
All	77.87%	82.50%	74.37%	53.62%

As is evident from the Table 2, in the questionnaire relating to restoration of Pakistan's conditional membership of commonwealth, the most significant factor with (p=0.000) level of significance was the cover letter (Chi-sq=29.126, Phi=0.191). Further analysis about the direction of association showed that

cover letter was negatively associated with non-response (OR=0.347) as given in Table 3. So cover letter made a significant effect in improving response rate in questionnaire on political issue.

Table 3: Odds ratio for the non-response by subject matter, font color, and cover letter, and follow up

Type of Issue or Subject matter	Correlate of non-response		
	Font Color	Cover Letter	Follow Up
Education System	0.34 (P=0.000)	--	0.34 (P=0.000)
Commonwealth membership	0.64 (P=0.016)	0.35 (P=0.000)	0.41 (P=0.000)
Drug Addiction	--	--	0.38 (P=0.000)
Terrorism	--	0.44 (P=0.000)	0.30 (P=0.000)

Note: Odds ratio are reported only for the categories shown as statistically significant at P< 0.05 based on Chi-Square test.

When the questionnaire relating to educational issue was used, the most significant factors at 5% level of significance were the color and follow-up (chi-sq=36.572, 36.572 phi=0.214, 0.214), which got maximum response rate i.e. 31%. Further observation of the direction of association showed that color and follow-up were negatively associated with non-response (OR=0.340, 0.340). So color and follow-up made a significant effect in improving response rate in questionnaire on educational issue. In the questionnaire relating to social issue, that is drug addiction, the most significant factor at 5% level of significance was the follow-up (chi-sq=33.063, phi=0.203), which got maximum response rate i.e. 34.50%. The follow-up was negatively associated with non-response (OR=0.382). So follow-up also made a significant effect in improving response rate in questionnaire on social issue. For the final questionnaire, focused on terrorism as a national & international issue, the most significant factor at 5% level of significance was the follow-up (chi-sq=69.872, phi=0.296), which got maximum response rate i.e. 61.75%. The follow-up was negatively associated with non-response (OR=0.295). So follow-up made a significant effect in improving response rate in questionnaire on national & international issue.

It was observed that in the questionnaire on political issue, that is, Restoration of Pakistan's conditional membership of commonwealth, having colored font, presence of cover letter, and follow-up, each were associated with an increased response rate by 6.5%, 14.5% and 12.5% respectively. In the questionnaire on System of Education in Pakistan, having colored font, and follow-up each were associated with an increased response rate by 17.75% and 17.75% respectively while the factor cover letter decreased response rate by 5.25%. Lower response rate with the cover letter is a rather unexpected finding. Yet, it can be interpreted as an indication that the topics that are self explanatory and are not very sensitive, cover letter may not make any difference, or it may even be considered unnecessary burden. In case of the drug addiction questionnaire, having a cover letter and follow-up each were associated with an increased response rate by 3.75% and 17.75% respectively. Having a colored font decreased response rate by 3.75% and in the questionnaire on a national & international issue (terrorism). Having a cover letter and follow-up each were associated with an increased response rate by 20% and 29.5% respectively while the factor colored font made no effect on response rate. The above results suggest that of all the three factors, follow-up is the most effective in decreasing the non-response rate, (and thus increasing response rate).

Summary and Discussion

Internet surveys are fairly popular in developed countries and their use is beginning to increase in developing countries such as Pakistan. Our research takes on a unique research question for which no prior study exists in Pakistan. It investigates the effect of four factors on the non-response rate: (a) nature of the subject matter being studied, (b) font color of questionnaire, (c) follow up letter, and (d) presence of cover letter. In this study, we used e-mail to implement the Internet survey. The sampling frame was obtained from Aga Khan Research Institute, Karachi, Pakistan, consisting of fairly complete list of NGOs operating in all four provinces of Pakistan. Using the two stage probability sampling, a total of 1600 NGO employees were selected for this study. At the first stage of sampling, 125 NGO's were randomly selected as the primary sampling units (PSUs) from the list of 600 NGO's all over Pakistan. At the second stage, all employees with a valid email address from these selected NGO's were chosen to constitute the final sample 1600 NGO employees. The importance of our research is evident from a recent study's recommendation. Trouteaud (2004:385) in his conclusion emphasized that "further attempts … should focus on invitation and reminder e-mails" as a determinant o response rate. The overall response rate in our study was 28%. The response rate of Internet studies vary greatly. For instance Braithwaite and colleagues (2003) observed that the response rates in Internet studies review by them ranged from nine to 94%. They noted that sending follow-up reminders resulted in a substantial increase in response rates. Our analysis show that non-response rate varied substantially across four type of issues or subject matter studied in the survey, namely, Pakistan's Education System (77.87%), restoration of Pakistan's Commonwealth membership (82.50%), drug addiction (74.37%)., and terrorism as both national and international issue (53.62%). For the questionnaire relating to restoration of Pakistan's conditional membership of commonwealth, the most significant factor was the cover letter, presence of which improved response rate. When the questionnaire relating to educational issue was used, the most significant factors were the font color and follow-up, combination of which got maximum response rate i.e. 31%. So use of colored font and follow-up made a significant effect in improving response rate in questionnaire on educational issue. In the questionnaire relating to social issue, that is drug addiction, the most significant factor was the follow-up, which got maximum response rate i.e. 34.50%. So follow-up also made a significant effect in improving response rate in questionnaire on social issue.

For the final questionnaire, focused on terrorism as a national & international issue, the most significant factor was again the follow-up, which got maximum response rate i.e. 61.75%. As far as the interaction of the three factors is concerned, it was observed that in the questionnaire on political issue, that is, Restoration of Pakistan's conditional membership of commonwealth, having colored font, presence of cover letter, and follow-up, each were associated with an increased response rate by 6.5%, 14.5% and 12.5% respectively. In the questionnaire on System of Education in Pakistan, having colored font, and follow-up each were associated with an increased response rate by 17.75% and 17.75% respectively while the factor cover letter decreased response rate by 5.25%. In case of the drug addiction questionnaire, having a cover letter and follow-up each were associated with an increased response rate by 3.75% and 17.75% respectively. Having a colored font decreased response rate by 3.75% and in the questionnaire on a national & international issue (terrorism). Having a cover letter and follow-up each were associated with an increased response rate by 20% and 29.5% respectively while the factor colored font made no effect on response rate.

The results and conclusions of this study lead to a number of recommendations, noted below. These recommendations are addressed, in particular, to the low response rate in e-mail surveys. The effect of colored and black & white questionnaires has been discussed in the study. Similarly further work can be done on the effect of non-response by using different colors as separate factors like green, blue, red etc and different writing styles. The effect of sponsorship can be studied on non-response by creating a web based survey rather than an e-mail survey. Further research on the feasibility of the Web-based delivery of surveys is most certainly warranted. In this study, we have only used one follow-up to decrease non-response. It would be of interest to see the impact of second and third follow-ups on non-

response rate. Studies have used up to six follow up letters to obtain the best response rate (Braithwaite et al. 2003) Translation of questionnaire in local language may be another important factor to decrease non-response rate. Similarly other factors like length of questionnaires and question wording can also be considered. Studies investigating the effect of age factor, sex (male, female), social class (lower, middle and higher) and education level on response rate are also in order. A comparative study can also be made on mail, e-mail and web based surveys by introducing different factors or similar factors, which are studied in this thesis. Different sources of non-response can be studied as separate factors like refusals, not at home, not at the time of call and disability etc.

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Anti-proliferative Effects of local Plant/herbal Extracts on Human Tumor Cells

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Abstract: Extracts of local herbs and plants were screened against human tumor cell lines to see if any possess anti-tumor activity. It was found that extracts of some local herbs show cytotoxicty against cell lines tested.

Key words: herbs, cancer cells, anti-proliferation.

Introduction

Extracts of plants and herbs had been widely used in many countries and continue to be used and introduced to treat a variety of illnesses and to explore new drug discoveries. Herbs/plants may have an oncoprotective role due to their content of antoxidants such as polyphenols (1). Herbal extracts for example have been shown to inhibit enzymes associated with cancer cell proliferation and growth (2,3) and to reduce levels of oxygen free radicals (4). In this study we have tested many local herbs and plants against human cancer cells and show the effect of the following herbs and plants *Silybum marianum* (L.) Gaertn. (1791), *Micromeria fruticosa* (L.) Druce.(1914), *Beta vulgaris* (L.)(1753) and *Arum palaestinum* Boiss. (1854) on the proliferative ability of cancer cells . It is noteworthy to say that these herbs/plants are not used locally to treat any illnesses but some are used as food and not regarded to have well characterized medicinal benefits. It was found that leaf extracts**,** either aqueous or organic**,** of some of these plants possess an anti-proliferative effect.

Materials and Methods

Extract preparation:

Aqueous or organic extraction of these herbs/plants was done as described earlier for Olea europea. (5).

Cell culture and Proliferation assay: Human hepatocarcinoma cells Hep G2 and Hep 3B were cultured and assayed as described by Hasan et al (5)

Results and Discussion

The anti-proliferative effect of some local herbal and plant leaf extracts have been tested on human hepatocarcinoma tumor cell lines. It was found that some of these extracts inhibited cellular proliferation as shown in figure I. Treatment of cells with different concentrations for 3 hours have reduced cell proliferation up to 80% compared to untreated cells. This shows that there is an immediate and quick anti-proliferative effect for these extracts.The IC50 for *B.vulgaris* was 40%9w/v) and for *S.marianum* was 60% 9w/v).This figure also shows that hydrogen peroxide is more cytotoxic to cells than these herbs and has an IC50 of 25uM. It is also shown in Figure II that other extracts are found to inhibit cellular proliferation in a concentration and time dependent manner. Which is in good agreement with similar research carried out on different herbal extracts by many investigators. Chinese herbal

extracts were found to inhibit cell growth of gastric, colon and breast cancer cells (6). Many of the herbs tested by Li et al(6) were found to inhibit growth by affecting the cell cycle. Some extracts were interestingly found to increase cell proliferation especially at lower doses (Figure 2). It has been reported that herbal extracts can both inhibit and stimulate the growth of some human breast cancer cells (7). This indicates that there are substances in these extracts that may cause cell proliferation and that their effect could be masked by higher doses of other herbal constituents. Similar effects were seen with low doses of radiation (8) and other drugs used in treatment of cancer. It can be concluded from studies on the effect of low doses of therapeutic agents that a combination of doses of several agents is preferred (9,10).

Conclusion

This investigation shows that some extracts tested here have inhibited human tumour cell proliferation in a time and dose dependent manner while on the other hand it was found that some herbal extracts increased cell proliferation only at low concentrations.

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Figure I. The effect of organic leaf extract of two herbs on proliferation of HepG2 cells treated for 24 hrs in comparison to Hydrogen peroxide (1uM).
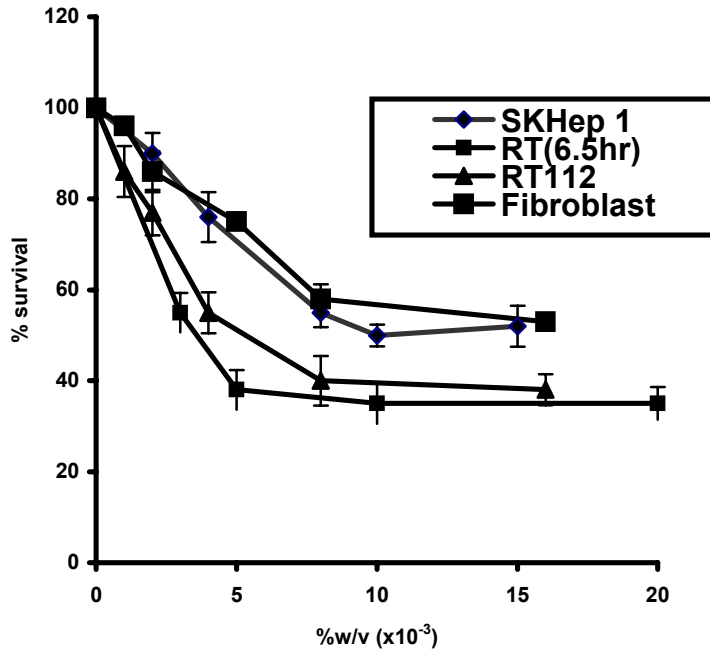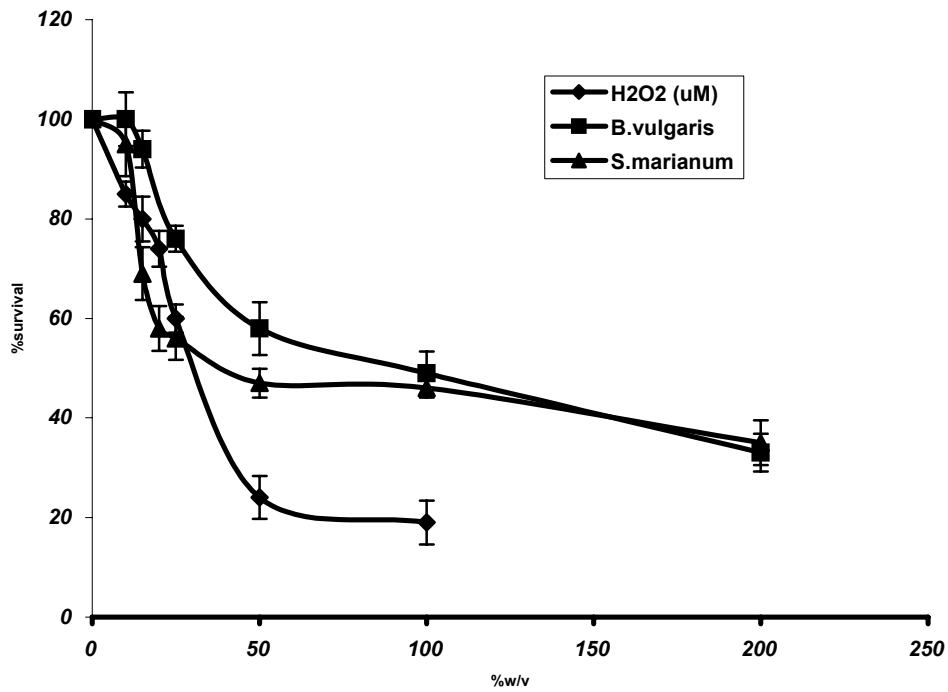

Figure II. The effect of *M.fruticosa* (0.75%) and *A plaestinum* (0.6%) on proliferation of HepG2 cells treated for different periods.

Change Process and Resistance to Change in Business Organizations in China*

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Abstract: With confronting more and more the competitive, uncertain and global economic environment, China's enterprises have been undergoing organizational change to meet the great challenges. Researchers have studied change process of China's enterprises at a macro level and resistance to change at a micro level. Based on the summary of the research achievements of organizational change in China's enterprises, this paper provides an overview on both change process and resistance to change by interviews and investigations and sets forth the dynamics of change in China's enterprises.

Keywords: change process, resistance to change, change strategy, change tactics

Introduction

China's economic system has made the transition from a planning economy to a marketing economy since 1985. During recent years, with China's access to WTO and the further opening of the Chinese market to international trade and investments, as well as with the increasing competition of the global economy, China's enterprises are confronted with great developmental challenges that they have never met in the history. To obtain better existing and developing conditions in the world economic

environment, transformations/changes in China's enterprises have been carried through in succession by forms of mergers or acquisitions among enterprises, by joint ventures with multinational/global companies, by joint-stock alteration in state-owned enterprises and by the development of private and family enterprises. However, no organizational change is a plain sailing. Change means to change an organization by technological innovation, organizational structure modification, personnel re-allocation, business processes reconstruction and organizational culture re-shaping. In particular, the transformations in China's enterprises urgently need introducing more advanced technology into the enterprises. This means that change demands individuals and organizations to alter their old thinking styles and intrinsic behavior patterns, to learn and accept change for their jobs and lives, and to establish innovative thinking styles and new behavior patterns to adapt to the challenges evoked by the new technological and informational environment. However, extensive transformation practices in China's enterprises indicate that in the process of organizational change, there are various resistances to change within organizations, some from individuals, some from groups/networks and some even from the whole organization. Successful organizational change projects have shown that taking useful measures and change tactics to overcome resistance to change is the only way to implement change and achieve organizational development. For example, Shanghai Baoshan Steel Group, a large-scale steel corporation that holds more than 15,000 employees, successively took the first change from production oriented to finance oriented in 1993 and then took the second change from finance oriented to customer oriented in 1998. In the second change, Shanghai Baoshan Steel Group took the lead among domestic enterprises in developing a new branch-ESI (Enterprise System Innovation) to optimize business process redesign, restructure the organization and establish an advanced information management system to support the innovated organization. In the two great changes, the top leader team in Baoshan Steel Group was confronted with unimaginable difficulties and resistance from different levels in the organization. They did a lot of work to cope with resistance to change from staff and managers by using tactics, such as foremost checking common understanding about change among staff and managers, training people who experienced a change in their position with advancing technology before the start of change, arranging appropriate alternatives for people who lost jobs in the change process, rewarding innovative people who made contributions to change, and finally they gained rational and behavioral support from staff and managers for the change. Thus people's resistance to change in the organization was reduced as much as possible after these valid measures and tactics were used. Furthermore, it is just these two changes that made Baoshan Steel Group finally become a competitive enterprise in Asia.[2] Yunnan Winery is another example of a Chinese Company that underwent a huge development during five years by innovating marketing strategies. The innovations in Yunnan Winery also experienced the process of resistance to change and the use of change tactics to cope with resistance.[3] Herewith many change practices of China's enterprises provide abundant information for researchers to explore change/ transformation process in enterprises at a macro level disclosing characteristics of the organizational change process, and resistance to change occurring in implementing the change process at a micro level. Based on the summary on the research achievements of organizational change that researchers have made in recent years, this paper provides a view on both change process and resistance to change together with the results from interviews and investigations and sets forth the dynamics of change in China's enterprises.

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1 L.Y. Song, "The Second Revolution in Baoshan Steel Group," October 18, 2002.

   http://www.ccw.com.cn/htm/center/app102_10_18_2.asp

2 Case Study on Marketing Strategy of "Red Yunnan" in Gaoyuan Winery in Yunnan Province," Nov. 24, 2004.
   http://ing.21food.cn/news/showNews.jsp?id=23134

Literature Review on Change Process and Resistance to Change

Literature on Change Process

Many researchers offer different models of the change process. Lewin (1947) proposed a three-phase model of the change process, that is unfreeze, transform and refreeze. Based on the study of terminally ill patients, Kubler-Ross (1969) described change process as a process of death, dying, and rebirth. Zell (2003) pointed out that individuals experience several stages in Kubler-Ross's model of the change process: denial, anger, bargaining, depression, and acceptance. Researchers as Wang (F.B. Wang, 1994) described that the organizational change process in China's enterprises includes three stages: preparing and planning, testing and popularizing, evaluating and reinforcing. In preparing and planning stage, firstly diagnosing problem and recognizing the necessity and urgency of change, secondly taking measures to increase the driving force for change and reduce the restraining force for change, thirdly making specific scheme for solving problems and beginning management training. In the testing and popularizing stage, a try-out project is the first step, and then based on the successful testing results, popularizing it and implementing change all-round. In the evaluating and reinforcing stage, confirm the effectiveness of change behavior. If change is effective after evaluating, it is necessary to reinforce the new mode of behavior using measures of reward and punishment. Lin (2001) stated that a change process may have several phases such as: identifying need of change, diagnosing change problems (change area), classifying the limited realistic situation to make sure that to which extent change may involves, selecting change strategy and tactics, implementing change, and evaluating change results. From a view on information processing, Wang (G.Y. Wang, 2001) provided a model of the change process, which included five phases: collecting information, analyzing information, feedback of information, implement the change, and evaluation of the effectiveness. Dai (1998) described the change process as a four phase's process: setting up formal or informal organizational change committee; focusing upon middle managers and key departments; building up change scheme, including documents and practices; and implementing the organizational change through the whole organization.

However, some researchers as Whelan-Berry and Gordon (2000) argued that few of the existing models of change are comprehensive organizational change process models, and cannot explain the whole characteristics of the change process. Gordon analyzed that an organizational change process is a multi-level process that includes individual change, group change and organizational change, and can be described correspondingly at individual level, group level, and organizational level. Existing studies focus much on individual level change process mostly from a psychological point of view, and scarcely on the change dynamic at group level as well as leaving unsettled questions about the organizational level, such as how individual and group change are processes transferred into the organizational level.

About change strategies, researchers point out that the strategies of change may have different styles. Top-down is regarded as the traditional and frequently used change strategy in many companies (Bourgeois & Brodwin, 1984). Finstad (1998) noted that if change starts at grassroots level, it is difficult to establish a broader consensus in the top. Based on investigation results of performance evaluation in some China's enterprises, Guo (2002) stated that the change strategy in China's enterprises should be top-down. They argue that getting support from top leaders and achieve innovation by the leaders are the most important things when change starts. Since change will bring some uncertainty on people's benefits, few people like to accept change actively. Only when the uppermost leaders support change and give great efforts to get rid of various interferences, people can handle change carefully. Thus it seems to be quite difficult for middle level leaders to initiate and lead change. They can only cooperate with the top leaders to manage change. But Jin (T.J. Jin, 2001) argued the upper leaders' acceptance of change is just a precondition, change can start up from the middle or lower level. However, many researchers agree on the observation that the style of change in China's enterprises may be top-down change, bottom-up change, up and down change according to the range, content and characteristics of change itself (Y.S. Li, 1988; Y.N. Zhang, 1989; X.J. Yang, 1990; F.B. Wang, 1994; Yu, 2002).

Jin (T.J. Jin, 2001) and Geng (2003) also explored the most effective style of processing change in China's enterprises. They considered planning change is more suitable for China's enterprises than gradual change and revolutionary change. They analyzed that gradual change will meet the smallest resistance but has the least effectiveness, revolutionary change will produce the greatest shocks to people and may meet the biggest resistance among the three styles; whereas planning change can give time to people preparing for change both in awareness and in emotion, thus it may meet smaller resistance when change begins. This style of processing change is known in the literature as "Planned Change". Planned Change can be defined (Levy, 1986) as "the change that originates from a decision to deliberately improve the functioning of the organization, mostly by engaging an outside Resource Person". According to the extensive literature, such a Consultant or Change Agent will:

Improve the ability of the Organization to adapt to the changes in the economic, social or technological environment (Beckhard, 1969)

and/or improve the effectiveness of the total Organization (Bennis, 1966)

in an "action-research" oriented process (French and Bell, 1984)

that is mainly based on Behavior Science theory (Huse and Cummings, 1985)

and is facilitated by a specially appointed resource person (French and Bell, 1984)

Whereby the change is ultimately based on the change in behavior of the individual organizational members.

The behavior of an individual can be analyzed into the following (cognitive) components (Goodman and Dean, 1982). See Table 1.

Table 1   Individual Behavior Change Phase

Awareness of the need to change	developing (knowledge about) more suitable or appropriate ways of coping	Selecting (in a process of testing and comparing) an alternative to the existing way of operating	Adoption (actively or passively) engaging in the new way of operating
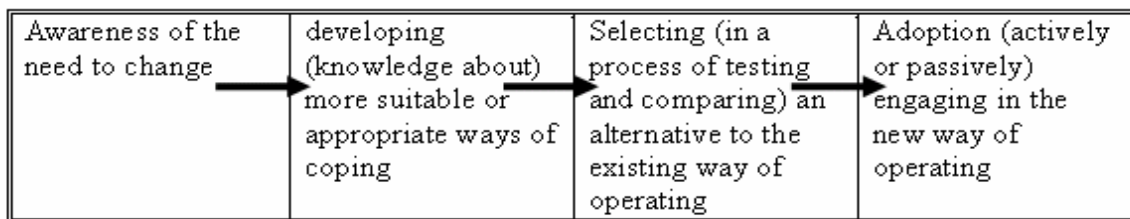
In the phase of awareness, many people just have a simple, misty or unclear notion about change; this notion often comes from informal ways such as by hearing from other people. As this kind of information is not coming from the formal ways, people seldom really consider the relationship between this information and the possible change and cannot carefully think about the meaning of change, and there is no negative emotion caused at this period of time because people might think change has nothing to do with them, so they may have no need of change, change may be the business of others, not theirs. As the news of change is gradually confirmed officially, more people think that change is inevitable, they will try to collect more information about the coming change through formal and informal channels. In this way they can get to understand the true meaning of change for them, thus the necessity of change for the organization is evaluated as well as the possible economic benefits, while some managers will notice the possible implications for their leader positions. So after a period of seriously thinking about change, at the end of this phase, some people still will oppose the change and sometimes the opposition will be strong. At the same time many people have reached relatively accurate understanding of the necessity of change, namely the meaning of change for the organization development, but they have no detailed plans or ideas on what they should do and how to handle in the change. Most of them just observe calmly and wait to see the further change actions of the top leader team of the organization.

In the phase of interest in more suitable ways of coping, as a result of a lot of publicity on change in the organization launched by the top leader team, people have clear, specific and definitive awareness and knowledge of the needed change. Some positive emotions rise among people, they are eager to know more details of the forthcoming change, they will ask questions about the change and voluntarily collect relevant information. People abandon some worries and apprehensions and put up strong, specific and practical interest in the change activities. During this period, change attitudes and behaviors of some "key people" who are respected in the networks or in the organization are very crucial, they greatly influence change attitudes and behaviors of other people in the networks and in the organization. Nevertheless there are still a number of people who have attitude of waiting to see what will happen, and there even exists some resistant voices on change.

When coming into the phase of selecting an alternative, the most obvious characteristic is that strong interest and awareness of change can't satisfy people's feelings on change and they raise a desire to have a try and take it into practice, and then some pilot tests precede one after the other in the organization. Successes in the tests not only give people great confidence on change but also make people who observe or oppose change start to treat change in a new and positive way.

In the phase of adoption, actively implementing change by changing their own behavior becomes a collective or team objective, more and more people accept change and start to believe in the change. They energetically carry through change and affect those who are still in phases before adoption and help them to participate in the change effort. However, there still exist a few people who resist change constantly.

Individuals differ in the willingness or speed to adapt and go through the phases of the change process. According to Rogers and Shoemaker's (1971) classification on the time of accepting and adopting change, there are five types of adoption: pioneer, early adopter, early majorities, late majorities and resister. Rogers and Shoemaker pointed out that most people are early majorities and late majorities, fewer people are early adopters and resisters, and the fewest people are pioneers. This point is also confirmed in our interviews.

In the research we find that the top-down strategy of change is more common than other forms. People especially in state-owned enterprises are relatively more dependent on their leaders to change and less active for change than those in companies that are joint ventures with foreigners, as well as private and family companies. Given the specific conditions in China's enterprises, when starting a change, top leaders in the organization should carefully consider the benefits that change will bring to staff. It is also very important for top leaders to take useful measures to push people to make the transition from awareness phase into adoption phase as soon as possible and help people adapt to the changing environment quickly. Finally when top leaders encourage and reward innovative people, and pay attention to fostering everyone's ability to change, change will become a thing that is seen as needed by everyone. In this way change can start from everywhere and everyone that is needed in the organization and it will not be considered as a top-down strategy as mostly happens at present.

Literature on Resistance to Change

Research on patterns of resistant

As the transition to a new way of operating implies that one has to give up the old trusted way of operating as well as the associated rewards for an uncertain new way of operating, it can easily evoke negative emotions about the new tasks, demands and responsibilities. The manifestation of these emotional reactions is known as "Resistance to Change". Therefore the required ultimate change in manifest behavior is not only determined by cognitive but as well by emotional processes.

Researchers (Yu, 2000; Lou, 2001) point out that in China's enterprises, resistance to change may be represented directly and indirectly, openly and latently. They indicate that direct and open resistance is relatively easier to handle, such as complains being heard everywhere, workers resisting learning new

technology, slowing down, committing errors, making rumors and chaos, attacking persons who arrange aversive conditions, stealing from the workplace, and deliberately sabotaging, which reactions are also discussed by western researchers (Judson, 1991; Skinner, 1971; Robinson & Bennett, 1995; Lee & Allen, 2002). Nevertheless, researchers state that indirect and latent resistance is more difficult to cope with. Things like feigning to be ill and not working, supporting change in words but actually acting against it is typical forms of indirect resistance. Researchers consider that indirect resistance is tricky, partly hidden and partly visible, and hard to be identified, whereas it can lower people's loyalty to the organization and make them loose passion for the job. Researchers note that delayed reaction to resistance is also harmful to change, because it is difficult for innovators to find the relationship between the headstream of resistance and the reaction to resistance. Potential effects of this kind of resistance might be exposed after several months/years, and turn out to be the fatal failure factor of change. Researchers emphasize on alarming indirect and delayed resistances during organizational changing. Various researchers (Robinson & Bennett, 1995; Lee & Allen, 2002) argue that all workplace resistant behavior and deviant behavior can violate organizational norms and have a negative impact on organizational development. Some Chinese researchers (Lin, 2001; Peng & J. Li, 2003) also observed the emotional and mental reactions of resisters. Anxiety, fear, denial, anger, depression, wait-and-see, and indifference are considered to be the typical emotional reactions when people resist change. These emotional reactions of resistance have also been confirmed by western studies (Goltz, & Hietapelto, 2002; Zell, 2003). Furthermore, many researchers explore reasons for resistance to change. Goltz and Hietapelto (2002) addressed resistance to change and the relation to power. They stated that the "resource power", that is the power to reward or punish others can be affected by the change activities. This resource power can be under direct control of a manager or it can be indirect when a person has such a good relation with a manager that he can influence rewards and punishments of others through this manager. The hypothesis of Goltz and Hietapelto is that the (potential) loss of this direct or indirect resource power can lead to a very intense resistance to change. This could explain why Chinese managers are so concerned about "losing face", or why a short-cut by going directly to a higher manager if the lower manager is not co-operative, can lead to increased resistance from the side of the manager who is caught in the middle. Kotter (1996) listed the following eight reasons for resistance to change:

Not discussing the need for change,

Failing to create a powerful guiding coalition to communicate the need for change,

Underestimating the power of a specific individual, and his challenging vision and goals,

Under-communicating the vision to the various stakeholders,

Permitting obstacles to block the attainment of the vision,

Failing to create short-term wins that could generate enthusiasm and confidence,

Declaring the change effort a success too soon, and

Neglecting to anchor the various changes in the corporate culture.

Seijts and O'Farrell (2003) analyzed that the traditional change style emphasizes much on communicating facts rather than emotions and feelings with the result that few change efforts are successful. They pointed out that resistance to change may be greatly reduced, if leaders communicate messages in a way that evokes employees' emotional response. Duck (1998) argued that change is basically about feelings and that people need to bring heart, soul and spirit into the change. Recently more researchers start to consider that when change is based on both communication of facts and emotional communication, it will result in the least resistance to change and often obtain success (Fox & Amichai-Hamburger, 2001; Goleman, 1998; Seijts and O'Farrell, 2003).

Resistance to Change at Different Levels

Resistance to change might occur from individual level, network/group level and organizational level. Chinese Researchers (L.G. Wang, 2003; Y.X. Yang, 2001; X.B. Wang, 2003; Lin, 2001; F.B. Wang, 1994; et al) have done a great deal of work to analyze these three level resistances in China's enterprises. The findings can be summarized as follows:

Resistance at Individual Level

When change comes, individuals might resist change. It normally is related to the following reasons:

Behavioral habits and interpersonal relationships being broken: During long working time, individuals form their behavioral habits and interpersonal relationships in the workplace. When change comes, it means the former behavioral habits and interpersonal relationships could be disrupted. Especially disruption of the individual's interpersonal relationship would cause negative emotions in the individual, because Chinese think a good interpersonal relationship is very important in the workplace and they can share mutual benefits in their works and even in their lives. A good interpersonal relationship needs much time to develop and can be maintained a long time even the whole life time, and if it is formed, there are mutual trust and support among people, and people get along well with each other just like family members. Change might disturb the psychological balance in the original interpersonal relationship, so resistance rises, even while an individual may not be aware of this.

Job security being threatened: Change will often disturb the job security of individuals. Those who have a high need for job security tend to show a high level of resistance to change.

Cognition error: Some staffs think change is a mistake made by leaders, and there is no need for change in their company now. They can't understand the necessity and urgency of organizational change and wouldn't like to change the status quo.

Economic benefit being related to change: When economic benefits are related to the reasons that necessitate change, individuals resist change as they fear that change would reduce their present income. They would rather maintain what they have now than take a risk losing these benefits.

Inclination to avoid uncertainty and risk: If individuals do not recognize the significance, the objectives and the benefits of the change, they will resist change in order to avoid the uncertain results and risk that change might bear on them. Risk avoidance has been entrenched in Chinese culture through millennia of conformance with traditional values and this is evidence in both arts and education, where creativity outside "the norm" is minimal.

Selective information processing: Individuals are inclined to select information that they think is advantageous to them and to neglect what they think is disadvantageous to them. Possibly because of the uncertainty of change, individuals might pay more attention to disadvantageous information about the change and resist change extremely.

Contract with the organization being changed all of a sudden: Change alters the original contract between the individual and the organization. This refers to the original economical, psychological and social contracts between individual and organization. Although a psychological contract is a kind of psychological expectation and not be written on paper, it plays an important role in the normal relation between employer and employees. When individuals are asked to change, contracts, especially psychological contract are disrupted suddenly, and some feelings such as disappointment, despair with the organization and being deceived by the organization are spreading among the employees, so change resistance quickly rises.

Distrusting change leaders: Change leaders haven't showed in the past enough innovating competence, good communication, nice cooperation and favorable characteristics to implement change. Individuals don't trust them and doubt if the leaders can bring benefit to them through change, thus before they are convinced of the quality of the leaders they resist any change.

Existing resources redistribution: Change means that resources are redistributed. Persons who hold and control the resources fear the reduction or even loss of their existing resources and power if change

is introduced, so they might resist change completely. Researchers think the middle and the lower managers hold the present power in the organization, they would be the main resistant individuals to avoid losing their authoritative status. This view is also highlighted across cultures (Goltz & Hietapelto, 2002; Boyee, 2002; Gavin, 2003).

Resistance at network level

There are various formal and informal groups/network in the organization. When change violates benefits of most people in the groups, group members or group leader, resistance occurs. Different groups resist change for different reasons. Formal groups, such as the group of skilled workers, of technicians and technologists often worry about their existing professional capabilities that can't meet the needs of change and they must learn to master new professional knowledge and techniques adapting to the change. When they feel change might bring more pressure on them or change might make them lose their jobs, they will resist change as a group. Especially the middle manager group might be more concerned with the threats of losing existing powers and resources. If they think that the cost of change is to lose power or if they lack competence to adapt to the change, resistance can be expected to happen from this group. Top managers will experience greater leadership challenges when they are confronted with organizational change. Those top managers who have weak leadership skills in a change project would stress the importance of stability of the organization and vote against change because they not only worry about losing their leadership position but also fear to loose the respect that comes from their leader position. Zhao (2001, 2003) stated that professional development of managers is the developmental trend for the managers in china's enterprises. He indicated that normative and specialized manager training is the key way to improve Chinese managers' leadership in facilitating organizational change processes in China's enterprises (Zong & Zhao, 2004).

Resistance to change always occurs in informal groups/networks in the organization, such as the group that is formed by old people who would rather want to stick to the previous successes of the organization than take the risks of change. The network formed by laggards in the organization is the group that may always resist any change. Those networks that are built on member's similar hobbies, values, interests will have two sides. If organizational change accords with their values and interests, they will participate in change actively; if not, they will resist change. Yu (2000) described that whether the attitude of these networks to change is active or negative, it might have large impact on change because all information spreads quickly in the networks and it is easy to reach consistence in behavior among network members. Wells (1990) stated that groups have their identities and behave distinctly from other groups but follow the dynamics of the own group. Yu stated that group rules deeply control group members' behavior whether the group/network is formal or informal. Groups/networks resist change through clamping down pressure to group members using group rules. So if the group resists change, even though someone in the group wants to accept change, he will get pressure from the group and has to give in. For example, a member of the labor union likes to change, but if the rules of the labor union ask him to resist any change decided by the employer, he has to resist. Researchers think such groups as the professional group and the middle level managers groups are expected to be important resistant forces against change. However, though middle managers are viewed as a blockage or having a negative affect on change when downsizing and re-engineering started in organizations in the 1980s and 1990s (Cameron et la, 1991), now some researchers begin to see the role of middle managers from a new perspective. They stated that the middle managers are a strategic asset in implementing change (Floyd & Wooldridge, 1994, 1997). Balogun (2003) argued that middle managers act as change intermediary and complete four roles in the change process, namely undertaking personal change, helping others throughout the change, keeping the business going, and implementing changes to departments. Balogun thinks that these potential roles of middle managers can facilitate change only when there is recognition of the strategic implications of down-grading the middle manager role, and when the traditional views of what it means to be a manager are reconceived. If this is not the case, middle managers will possibly become resistant to change.

Whether resistance comes from one of these networks, the strength of resistance and negative effects brought by it are much bigger than individual resistance. If we analyze characteristics of networks and their relationships in the organizations, we can understand it clearly by Figure 1. As Figure 1 shows, every network in the organization has its sphere and borderline, and within a sphere mutual trust and support is higher than outside these spheres (other networks), so there is a high cohesion in a network, and members within a network always have the same behavioral styles. However, networks are not completely isolated. While a person is a member of one network, at the same time he may also be a member of other networks.
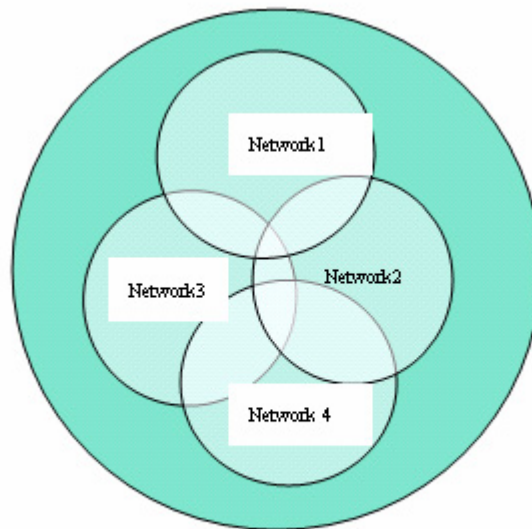
Figure 1 Networks in organizations

So networks in organizations are connected with each other not only by organizational task requirements but also by interpersonal relationships. Those who are in more than one network become persons spreading information between networks. Thus, at a network level in organizations, information is distributed transversely and it has a quicker spreading speed and larger impact than vertically distributed information. When resistance to change occurs in one network, other networks in the organization know it instantly and might resist change almost at the same time if they think it is necessary to resist. As we found in interviews with foreign managers in joint venture companies in China, foreign managers are always surprised at Chinese's network trust and support that are more group based than organizational based. Due to lack of good communication skill and also with little understanding of Chinese's unique characteristics of trust and support, foreign managers often meet difficulties to successfully manage their Chinese employees. For example, in some foreign companies, when foreign managers ask Chinese people to implement change, they just simply give orders and do not permit Chinese staff to make any mistake in their jobs. This kind of management is disagreeable to most Chinese staff, since they feel they loose esteem and trust and experience negative emotions on what foreign managers have done to them, thus sometimes silent resistance or furious conflicts will happen between foreign managers and Chinese staff with their networks. Nevertheless, Chinese managers in state-owned enterprises often meet slight resistance or even no resistance because they always ask more details about how change has an effect on networks especially impact on staff's lives and work. They help the people in the network to settle the problems as they can, so people will think that their leaders care, respect and trust them, and they always experience more positive emotions and feel a strong sense of attachment to the organization whereas this can't be obtained from foreign companies.

Resistance at organizational level

Many researchers think resistance to change can also derive from the organization itself. It may include such things as:

Organizational structure inertia: The Organization has its inherent mechanism to keep stability, such as various bylaws. When the Organization changes, structural inertia acts as counterforce that maintains the organization's stability.

Organizational culture inertia: Once organizational culture is formed, it becomes steady, maintains the existing culture and accepts consistent culture and excludes an antagonistic culture. Organizational culture inertia resists the development of the organization. Compared with Organizational structure inertia, it is a more latent resistant factor.

Change just for a department but not the whole organization: The change project just changes a department or a subsystem of the organization and it creates conflict with other departments or subsystems of the organization, so resistance to organizational change can be expected to occur.

The role of Culture in resistance to Change

Hofstede(1980) studied cultural characteristics in 40 countries in the world and identified four national cultural dimensions that he thought deeply affected people's behavior styles: power distance ("P" for short), uncertainty avoidance (U), individualism-collectivism (I-C), and masculinity-feminine (M-F).

Power distance means that power, which is admitted by society or the organization, is very unequally distributed in the organization. It also indicates the distance between the managers and staff in the organization. Uncertainty avoidance refers to uncertain and ambiguous threats in the environment that are experienced by society or the organization, which causes measures to provide security in order to avoid uncertainty. Individualism-Collectivism dimension means the inclination that an organization puts emphasis on individual values or on collective (organizational) values. Masculinity- Feminine dimension indicates proneness of some predominant characteristics that are regarded as "masculinity" in the society such as confidence, seeking money and materials, etc, or on the contrary characteristics that are regarded as "feminine", for example, lack of confidence.

People's characteristics in four culture dimensions are measured by index value, the higher the index value is, the stronger the characteristics in a dimension, and vice versa. Part of Hofstede's research results is listed in Table 2.

Table 2 Indexes between different countries' culture dimensions

Dimension	Hong Kong, China	America	France	Britain	Netherlands
P	60 (high)	36 (low)	77	35	35
U	31	43	86 (high)	36	51 (low)
I-C	22 (C)	94	72 (I)	92	88
M- F	58 (M)	71	40 (F)	61	22

Note: Numbers are the index values of the countries in four culture dimensions; high index values indicate high (strong) characteristics in dimensions, low index values indicate low (weak) characteristics in dimensions.

Given that Hofstede's original research did not include materials from China mainland, Yu (2000) started a research comparing culture differences between Chinese and America using Hofstede's four culture dimensions (see Table 3). He came up with the following findings:

Table 3 Differences between Chinese Culture and American Culture

Dimension	China (Mainland)	America
P	high	low
U	strong	weak
I-C	strong collectivism	strong individualism
M- F	slightly higher than	equal level in
	Moderate masculinity	masculinity and feminine

Source: From W. Z. Yu, *Psychology of Management*, Northeast University of Finance and Economics Press, 2000.

The Chinese culture has almost opposite characteristics compared with the American culture on the four culture dimensions. He argued that the unique characteristics of Chinese traditional culture could affect Chinese organizational behavior just the same as American culture does. Differences between Chinese culture and American culture make different behavioral patterns between the two countries, which are described in Table 4.

Table 4   Differences behavioral patterns between China and the United States

	Behavioral Patterns
China	Seeking for security and quality of life, emphasizing on developing good relationship with people in the workplace, reducing or avoiding competitive relationship with people in the workplace.
The United States	Seeking for achievements and successes, enjoying looking for risk, Like to find work with the characteristics of change, challenge and competition; emphasis on professional development.

Source: Some of the ideas are from Yu, W.Z. *Psychology of Management.* Dongbei University of Fiance & Economics Press, 2000.

So from Hofstede and Yu's studies, we find that Chinese in the mainland are not just greatly different from Europe countries and America in behavior styles, but also different from Chinese in Hong Kong. These behavioral patterns that are formed and affected by cultural characteristics are confirmed by other studies (Yu, 1996, 1997; Yu & Lu, 2002; Liu, 2003; X.M. Jin & Huang, 2003). Researchers stated that when an organization needs change, these intrinsic behavioral patterns would resist change in Chinese's awareness and behavior and seek for maintaining stability and security in the organization, because in some way, Chinese traditional culture relatively encourages more stability and security rather than change and innovation. Tony Fang (1999) stated that behavioral styles of Chinese in the mainland are deeply affected by traditional culture; Chinese would rather like to get along well with each other and nurture mutual interpersonal relationship than compete with people or take risk for achievements. He also argued that Chinese have long been affected by Confucian culture So Chinese put an important weight on developing personal relationship with people for mutual trust and support in their lives and workplaces. However, he indicated that the "family oriented" Chinese culture makes individual trust more important than organizational trust (whereas the latter is always regarded as a consequence of the former), so if the foreign companies want to do business with Chinese, they must understand the

importance of taking time to cultivate and develop a relationship of trust with the Chinese at the personal level and not just at organizational level. In that way foreigners will meet the least resistance from Chinese business organizations.

In a way, some traditional cultural characteristics of China have blocked Chinese enterprises' development today. Change practices from Shanghai Baoshan Steel Group, Shandong Haier Group[3] and other successful corporations indicate that by breaking old-fashioned behavior patterns and establishing new, innovative behavior patterns Chinese enterprises can improve their competences for self-change and self-innovation and gain the opportunities to compete with most companies in the world. Researchers point out that this is the basic way for Chinese enterprises to obtain continuous development nowadays and in the future (Hu & Wan, 2003; Yu, 2000; F.B. Wang, 1994).

Change Tactics against Resistance

Geller 2002 suggested 14 distinctive characteristics of leadership that can decrease resistance to change and increase desired behaviors, namely:

Building responsibility instead of holding people accountable,

Focusing on process instead of focusing on outcomes,

More focusing on intrinsic consequence than extrinsic consequences,

Giving more supportive feedback than corrective feedback,

Educating first instead of training only,

Preferring to use conditional directives to unconditional directives,

Listening first and then speaking instead of speaking first and then listening,

Asking questions rather than answering questions,

Promoting more ownership than compliance,

A preference for facilitating mindful choice instead of limiting mindful choice

Setting expectations instead of mandating rules and policies,

Facilitating change by use of simulations and inspiring others, instead of imposing rules and regulations and measurement by numbers.

Inclination to treat people as individuals, not falling victim to stereotypes,

Directing, supporting, coaching, or delegating instead of just directing.

Kotter & Cohen (2002) proposed that change can be turned from a hard, factual project to a soft, emotional one by emphasizing less on facts and more on emotion, and by creating the see-feel-change pattern connected with successful change. The specific tactics are as follows: making the need to change real; deciding how to proceeding change from individual, team, and organization in details; developing a vision that is clear, creative and viable; communicating simply and sincerely; making individuals express how hey feel about change; celebrating short-term success so to energize people; constantly implementing initiative till change effort reaches a success; and fostering people's views on change forever.

Researchers (Shen, 1986; J.B Wang & Z.H. Fang, 1987; Chao, 1989; Deng, 1989; L.G. Wang, 2003; Y.X. Yang, 2001; X.B. Wang, 2003; Lin, 2001; et al.) generalize effective tactics for change in China's enterprises from practical experiences, which are listed as follows:

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[3] Xihong Chen, "A Study on Malpractice in Traditional Organization and the Trends of Change," *Academic Journal of Inner Mongolia Industry University.* No. 1, 2004.   http://www.cekd.cnki.net/news/view/view_d.php?page=690

Publicizing and communicating: Through publicizing change and communicating sufficiently with staff, it will help staff understand the reasons that a change should be introduced in the organization, the objectives the organization will reach through change, the benefits that change will bring to both the organization and individuals.

This tactic can reduce resistance for change and is good for those organizations where exact information about change is unavailable or communication about change is poor. Publicizing and communicating are often implemented by using tactics such as: face- to-face meeting, group discussion, memo, internal magazine and lecture.

Participating: Invite people involved in change to participate in making change decisions and joining into the whole process of change. The sense of participating in change lets staff feel they are respected and trusted by the innovator. It effectively reduces resistance, and in the meantime, the change innovator may also get some useful suggestions for change projects from staffs through their active participation.

Training managers and staff: Offer training courses and skill-training to managers and staff in order to increase their skills and abilities for change. Training includes both technological and psychological knowledge and skills. This tactic can help people quickly adapt to the new environment with technological and psychological preparation that is needed for the change effort.

Rewards and punishment: Duly praise and reward staffs and managers, groups and departments, who actively participate in change and highlight some progress or achievements; In the meanwhile, duly criticize and punish those who resist and sabotage change. This tactic can produce a good change atmosphere in the whole organization.

Improving psychological endurance: Change generally imposes psychological pressure on people. People who have a high level of psychological endurance resist change in the lower-grades and people who have a low level of psychological endurance resist change in the higher-grades. As Yu (1989) pointed out in his investigation, people have the highest psychological endurance in life style change, the lowest psychological endurance in economical distribution style change, psychological endurance in labor style change and interpersonal relationship style change are among the middle level. Organizational change has close relationship with the changes of these styles. Improving people's psychological endurance for change is a good way to reduce change resistance. This can be done by using various methods such as encouraging people to take part in change directly, controlling the speed of change process according to people's psychological adaptation to change pressure, carefully dealing with the feedback information during change process to clear up people's misgiving about change.

Force Field Analysis: Use Lewin's force field analysis method to analyze all driving forces and restraining forces, list and analyze these factors, and take measures to process change by increasing the driving force and impairing the restraining force.

Fostering an innovative atmosphere in quiet periods: In peacetime emphasize on fostering staffs and managers' awareness of innovation in the organization by internal magazine, in-company forum and highlighting innovation examples for people to imitate. It can help people to realize that change is always needed as organizations develop and to let them alter their psychological contract fitting with the organization. Then whenever change really comes, people can calmly deal with it and resistance to change will fall at the lowest point.

It is critical, however, that the right tactics are used at the appropriate time. Based on Lewin's theory, Iskat & Liebowitz (2003) suggested some tactics that can be effective to reduce resistance to change for different stages of the change process. They pointed out that in the stage of unfreezing, tactics are useful as providing justification for the change, showing empathy to employees by appreciating the difficulties change will bring to them and communicating clearly on details about change with employees. In the stage of making a transition, it will be good to take tactics as explaining change benefits, establishing a highly respected transition management team, obtaining employees' participative input, being aware of the timing for change, maintaining job security, providing training and proceeding at a manageable pace.

At the stage of refreezing, it will be fine to use tactics as indicating top management's support, publicizing successes and making mid-course corrections where needed and providing employee services on problems like employee anxiety caused in the implementation of change.

As we found in investigations in Chinese enterprises, in the phase of awareness, tactics as articles in the internal magazine that introduce the change, management training for managers and benchmarking are more useful. While in the phase of interest in more suitable ways of coping, tactics as good news event (change achievements) reporting, face- to-face meetings and management training are also used frequently. In the phases of try-out and adoption, tactics as pilot test, creating an expert team and holding directors' meeting are proved to be effective tactics that can prevent resistance and facilitate change.

Planned Change in China

By way of summary we can identify the following characteristics of successful organizational change projects in China:

1. There is an overwhelming need for change, but at the same time there are various forms of resistance at individual-, group- and organization-wide level.

2. The essential conditions for successful change projects are:
- The support from the top-management leadership.
- The key members of the Organization must recognize the need for
  change. This requires that they have become aware of the existing
  problems or external pressures.
- An openness or willingness in the key Organizational Members to
  experiment with alternatives for the existing procedures.
The key source of energy for the change effort must come from the Organization Members and not from the Change Agent.

3. The experience with successful change processes shows that it is most critical to take special measures and tactics to overcome the resistance to change, following a "planned change" approach.

4. Resistance to change is either manifest or indirect and even latent. The latter forms are most difficult to cope with.

5. In dealing with resistance to change, special attention has to be given to:
- Communication of a convincing vision by the top of the Company
- Communication that focuses on the emotions and feelings of the
  employees.

6. Resistance to change in China is especially related to disruption of the individual's interpersonal relationships. Good interpersonal relationships are most important as they allow people to get along as family members.

7. Therefore a special form of resistance is at the group- or network level. If members of the formal or informal network (e.g. Middle level managers, older employees, laggards in the Organization) may feel threatened by a loss of power or status or if the job security is at risk, they will use pressure within and through the network.

8. Typical for successful Chinese change managers is, that they are very attentive to even small problems faced within groups. Subsequently they try to find a solution for these small problems. In this way the group-members feel that the manager cares and respects them.

9. This fits in with the cultural differences between Chinese and Western managers, especially the high value that is given to good relationships with people in the workplace ("Collectivism") and to the need for security and quality of life (Hofstede, 1980).

Future Research

As we can see, the existing literature on China's enterprises change focuses more on the organizational change process at the organizational level and in some way neglects the research of the individual and group change processes (Yu, 2002 et al). Change essentially and ultimately is change in the behavior of people. Future researches may notice more about various psychological, behavioral and social variables that impact on the behavior and emotion of individuals in change project, and further define those variables that affect the individuals' resistance to change and those that motivate change in different phases and different kinds of change. On this basis one can develop appropriate coping styles or tactics to deal with the change effort. At network and group level, future researches may also continue to look into the dynamic characteristics within and between networks and groups, especially disclosing the various dynamic relations among networks that might have an important impact on change. At organizational level, Chinese traditional culture has proved to have an important impact on people's behavior, so future studies may explore those culture characters that can promote people's feelings on participating in a change project and thus cultivate and re-shape innovative organizational behavior patterns to facilitate change. Now it is well known that the organizational change process is a multi-level change process at individual level, group level, and organizational level. Therefore questions such as how to understand the relationships among three levels and how to promote the continuous and quick interaction among them to implement change will eventually need to be studied in the future. As we noted earlier, today China's enterprises confront a more and more complicated and uncertain environment. Change is constantly taking place, and taking on new characteristics in a changing environment. So it is urgent that research in the future may not only go into the various forms of change but also focuses on the depth of organizational change and completes the task to disclose the whole set of characteristics and patterns of organizational change.

Implicit in the thinking about the change process is the importance given to behavior science theory and the role of the change agent. This is in sharp contrast with the reality of most organizations where many change projects are implemented but where normally a (project-) manager or a project team is responsible for implementing a change project. Unfortunately in the literature about planned change, limited attention has been given to the "Implementation Techniques". We have an extensive literature about change process theory, but very limited literature about the theory of changing.

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Gas–Particulate Flow Through Porous Media

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Abstract: Our main concern in this paper is to derive the partial differential equations governing the gas-particulate flow through porous media of variable porosity. The models are intended to parallel the existing single-phase of flow in porous media that take into account the effect of the porous microstructure. The governing equations are derived using intrinsic volume averaging and are based on Saffman's dusty gas model and take into account the cases of one-way and two-way interaction between the phases present. The effect of the porous microstructure on the flowing mixture is analyzed via the concept of the representative unit cell (RUC) and the analysis to flow is based on volume averaging the governing equations over a representative elementary volume (REV). A distinction is made in these models between consolidated and isotropic porous media through the concept of representative unit cell (RUC). The dispersion terms and the surface integrals in the developed models are also analyzed.

1. Introduction

Porous media and especially phenomena of gas-particulate flow and dusty fluid flow in such material are an important field of interest for geologists, hydrogeologists, researches in oil and fluid mechanics, petroleum and chemical engineers, physicist and scientists in many other disciplines.

The above and many other applications emphasize two important aspects of the study of gas particulate flow in porous media

(i) Models describing gas-particulated flow through porous media must accurately take into account the effect of the porous media quantities on the flow constitute on each other, this necessitates developing model that take into account the porous microstructure and its effects on the flowing phases.

(ii) Solutions of boundary and initial value problems that should accurately predict the flow patterns and the nature of the flow fields of the constituents involved.

A model describing the derivation of the dusty fluid equations was presented in [3]. This developed general model which accounts for inertial effects and two-way interaction between the phase present is cast in different forms that take into account different porous media structure. In [8] a set general averaged transport equations for multiphase system consisting of an arbitrary number of phases, interfaces and contact lines have been established and a structure for the system has been proposed and hydrodynamic interaction between the phases, interfaces and contact lines was also presented. The common features of dispersed two-phase flows from a continuum-mechanical approaches were examined in [12]. In [10] transport equations for the gas through porous media were derived using the Kenetic theory of gases to a supermixture of free gas and fixed in space solid molecules. A numerical models of fluid flow through porous media have been developed from microscopic and macroscopic properties in [9], where the Darcy's law relates the chief microscopic parameters of interest-flow rate, permeability, viscosity and pressure gradient – and many be involved to solve for any of these parameters when the others are known. In [2] equations governing flow of a dusty fluid between two porous plates with suction and injection were developed and closed - form solutions for the velocity profiles, displacement thickness and skin friction coefficients for both phases were obtained and graphical results of the exact solutions were presented and discussed.

A model describing the flow of a dusty gas in porous media was developed in [7] and it is based on the differential equations approach. It incorporates the factors affecting the gas-particulate mixture in the type of porous media where Brinkman's equation is applicable and thus inertial effects were ignored under the assumption of creeping motion in a high porosity medium. In this current work we present the Saffman's dusty equations which are considered for steady incompressible fluid flow. The basic concepts of volume averaging scheme will also be considered. The effect of the porous microstructure on the flowing mixture is analyzed by using the representative unit cell (RUC) and the analysis to flow is based on volume averaging the governing equations over a representative elementary volume (REV).

A distinction is also made between consolidated and isotropic porous media through the concept of (RUC). The dispersion terms and the surface integrals are also analyzed.

2. Preliminaries

Consider the flow of a fluid in an isotropic porous media and assume that the fluid contains a small bulk volume of dust particles. The same flow in free-space is governed by Saffman's dusty gas equations which are considered here for steady incompressible fluid flow in the following form

The dust-phase equations given by

The continuity equation

$$\nabla \cdot (N\mathrm{v}) = 0 \tag{2.1}$$

and the linear momentum equation

$$\mathrm{v}\nabla \cdot (\mathrm{v}) = \frac{k}{m}(u - \mathrm{v}) \tag{2.2}$$

The fluid-phase equations given by

the continuity equation

$$\nabla u = 0 \tag{2.3}$$

and the linear momentum equation

$$\rho u \nabla u = -\nabla p + \mu \nabla^2 u \tag{2.4}$$

where u and v are the fluid and dust macroscopic velocity vectors, p is the pressure, μ is the viscosity coefficient, ρ is the density, N is the particle number density, m is the mass of a single dust particle and k is the drag coefficient on the dust particle in the porous medium.

3. Basic concepts of volume averaging

Averaging processes are applied so that to obtain equations that don't contain the details of the flow. The advantages of averaging are less obvious. First, the various terms appearing in the macroscopic equations are shown to arise from appropriate microscopic considerations. Second, the resulting macroscopic variables are related to microscopic variables. Averaging of the microscopic scale conservation equations in order to obtain macroscopic scale conservation equations provides a powerful tool of analyzing flow in porous media

3.1 Representative Elementary Volume (REV)

A representative elementary volume (REV) is defined as an arbitrarily shaped control volume over which averages will be calculated [1]. This control volume is denoted by V and it will contain fluid and porous matrix in the same proportion as the whole porous media; that is, it is a control volume whose porosity is

the same as that of the whole porous medium. The pore volume V_φ will compromise the volume of the fluid-phase V_f and the volume containing the particle V_p clearly

$$V_\varphi = V_f + V_p \tag{3.1}$$

where the porosity φ is defined as the ratio of the pore volume to the bulk-volume of the medium. In terms of REV the porosity is defined as

$$\varphi = \frac{V_\varphi}{V} . \tag{3.2}$$

When averaging point equations, it is necessary to use an averaging volume of a size large enough that the averaged quantities obtained are meaningful and suitable for the flow under consideration. However, the averaging volume should not be so large that macroscopic inhomogenities affect values. For example, in terms of microscopic and macroscopic length scales λ and L respectively, the REV is chosen such that

$$\lambda^3 < V < L^3 . \tag{3.3}$$

3.2   Representative Unit Cell (RUC)

the concept of the (RUC) was introduced by [4], and is defined as the minimal (REV) in which the average properties of the porous medium are embedded such that

$$V_\varphi = \varphi \lambda^3 \tag{3.4}$$

where λ is the microscopic length defined in equation (3.3) that represents the average distance between pores.

For the sake of clarity, we list the following results [4] that are based on the concept of the RUC:

The total wetted surface within the RUC is given by

$$S = 3(1-\tau)(3\tau-1)\lambda^2 / \tau^2 \tag{3.5}$$

where τ is the tortuosity and is defined as

$$\tau = \frac{\lambda}{\lambda_e} . \tag{3.6}$$

The total tortuous path length within the RUC is given by

$$\lambda_e = \frac{V_\varphi}{A_p} \tag{3.7}$$

where A_p is the pore area, within the RUC and defined as

$$A_p = \left[1 - (1-\varphi)^{2/3}\right]\lambda^2 . \tag{3.8}$$

The porosity φ is defined as

$$\varphi = (3\tau-1)^2 / 4\tau^3 . \tag{3.9}$$

For granular porous media the RUC is represented by a cube of linear dimension λ aligned centrally within the solid element that is also of linear dimension.

The total wetted surface within the RUC is given by

$$S = 6\left[(1-\varphi)^{2/3}\right]\lambda^2 \tag{3.10}$$

and the tortuosity τ is defined by

$$\tau = \left[1-(1-\varphi)^{2/3}\right]/\varphi \ . \tag{3.11}$$

3.3 The averaging process

Let F be a volumetrically additive quantity of the fluid-particle mixture within the REV. The phase average F is defined as

$$\langle F \rangle = \frac{1}{V}\int_V F \, dV \tag{3.12}$$

the intrinsic phase average is expressed in the form

$$\langle F \rangle_\varphi = \frac{1}{V_\varphi}\int_{V_\varphi} F \, dV \tag{3.13}$$

It follows from equations (3.12) and (3.13) that the two averages are related by the expression

$$\langle F \rangle = \varphi \langle F \rangle_\varphi . \tag{3.14}$$

The relationship between the true quantity F and its intrinsic average is given by

$$F = \langle F \rangle_\varphi + F^{\rm o} \tag{3.15}$$

where $F^{\rm o}$ is the deviation from F.

Letting F and G be two volumetrically additive scalar quantities and F is a vector quantity then the following set of rules have been established [5]

(i) $\qquad \langle F \rangle = \varphi \langle F \rangle_\varphi = \varphi F_\varphi$

(ii) $\qquad \langle F \pm G \rangle_\varphi = \langle F \rangle_\varphi \pm \langle G \rangle_\varphi$

(iii) $\qquad \langle F\,G \rangle_\varphi = \langle F \rangle_\varphi \langle G \rangle_\varphi + \langle F^{\rm o}\,G^{\rm o} \rangle_\varphi$

(iv) $\qquad \langle \nabla F \rangle = \nabla \langle F \rangle + \dfrac{1}{V}\int_S nF ds$, where n is a unit normal directed into the solid matrix

$\qquad$ and S is the surface area.

(v) $\qquad \langle \nabla F \rangle = \varphi V\left(\langle F \rangle_\varphi\right) + \dfrac{1}{V}\int_S nF^{\rm o} ds$

(vi) $\qquad \langle \nabla \cdot F \rangle = \nabla \cdot \langle F \rangle + \dfrac{1}{V}\int_S n \cdot F ds$

(vii) $\qquad$ The surface integral over the fluid matrix interface vanishes if the integrand contains the fluid-phase and dust-phase velocities explicitly.

(viii) $\qquad$ If c is an arbitrary constant then $\langle cF \rangle = c \langle F \rangle.$

4. Averaging the dusty gas equations

In the Saffman's dusty model the effects of the flowing phases on each other are represented by a drag term proportional to the relative velocity of the phases involved. When the same dusty fluid flows in a porous medium the other interactions that occur are consequences of the introduction of the porous matrix in the flow domain.

We will therefore assume at the onset of the analysis that when a dusty fluid flows in a porous medium the effects of the phases on each other are represented by drag terms proportional to the relative velocity. This assumption eliminates consideration of the interfacial surface area between the fluid and dust phases.

In order to accomplish the intrinsic averaging procedure, we derive the required set of equations by adopting the intrinsic phase averaging procedure over the REV and applying the averaging rules (i) – (vii) to the governing equations (2.1) – (2.4) as follows:

Averaging the dust-phase equations

The continuity equation is

$$\nabla \cdot \left(\varphi \left\langle N_\varphi \mathbf{v}_\varphi \right\rangle \right) + \nabla \cdot \left(\varphi \left\langle N^o \, \mathbf{v}^o \right\rangle_\varphi \right) = 0 \tag{4.1}$$

and the momentum equation is

$$\nabla \cdot \left(\varphi \, \mathbf{v}_\varphi \mathbf{v}_\varphi \right) + \nabla \cdot \left(\varphi \left\langle \mathbf{v}^o \, \mathbf{v}^o \right\rangle_\varphi \right) = \frac{k\varphi}{m} \left(u_\varphi - \mathbf{v}_\varphi \right). \tag{4.2}$$

Averaging the fluid-phase equations

The continuity equation is

$$\nabla \cdot \left(\varphi \, u_\varphi \right) = 0 \tag{4.3}$$

and the momentum equation is

$$\rho \nabla \cdot \left(\varphi \, u_\varphi u_\varphi \right) + \rho \nabla \cdot \left(\varphi \left\langle u^o \, u^o \right\rangle_\varphi \right) = -\varphi \nabla p + \mu \nabla^2 \left(\varphi \, u_\varphi \right)$$
$$+ \frac{1}{V} \int_S \left(-np^o + \mu n \cdot \nabla u \right) ds \cdot \tag{4.4}$$

Equations (4.1) – (4.4) represent the intrinsic averaged equations governing the flow of a dusty fluid in porous medium in the case of one-way interaction. The deviation terms in these equations and the surface integral in equation (4.4) contain the necessary information on the interactions between the phases present and the porous medium. In particular, the surface integral represents the effect of the porous matrix on the flowing mixture.

4.1   Analysis of the deviation terms

The terms $\nabla \cdot \left(\varphi \left\langle \mathbf{v}^o \, \mathbf{v}^o \right\rangle \right)$ and $\nabla \cdot \left(\varphi \left\langle u^o \, u^o \right\rangle_\varphi \right)$ in equations (4.2) and (4.4) respectively are related to the hydrodynamic dispersion of the average dust-phase and fluid-phase velocities. Suppose that the high velocity and porosity gradients are absence, then we obtain

$$\nabla \cdot \left(\varphi \left\langle v^o \, v^o \right\rangle_\varphi \right) = 0 \tag{4.5}$$

and

$$\nabla \cdot \left(\varphi \left\langle u^o \, u^o \right\rangle_\varphi \right) = 0 \,. \tag{4.6}$$

Substituting equations (4.5) and (4.6) into equation (4.2) and (4.4) respectively, one obtains

$$\nabla \cdot \left(\varphi \, v_\varphi v_\varphi \right) = \frac{k\varphi}{m} \left(u_\varphi - v_\varphi \right) \tag{4.7}$$

$$\rho \nabla \cdot \left(\varphi \, u_\varphi u_\varphi \right) = -\varphi \nabla p + \mu \nabla^2 \left(\varphi \, u_\varphi \right) + \frac{1}{V} \int_S \left(-np^o + \mu \, n \cdot \nabla u \right) ds \cdot \tag{4.8}$$

The term $\left\langle N^o \, v^o \right\rangle_\varphi$ appearing in equation (4.1) is a dispersion vector of the average number density due to the influence of the average phase velocity vectors. If the particle distribution is uniform and N is constant then

$$\left\langle N^o \, v^o \right\rangle_\varphi = 0 \,. \tag{4.9}$$

However, if N is not constant then this term can be sufficiently quantified by modeling the dispersion vectors as a diffusion mechanism only. The term $\nabla \cdot \left(\varphi \left\langle N^o \, v^o \right\rangle_\varphi \right)$ appearing in the dust-phase continuity equation (4.1) represents the mass transfer Γ between the dust-phase and the porous medium in the form of setting of the particle on the solid matrix boundaries and the sedimentation and suspension of particles of the solid porous matrix in the flow field [5]. It should be noted that there is no mass transfer between the fluid-phase and the dust-phase. To quantify the quantity Γ we let ε be the mass transfer coefficient then in light of channeling concept of the porous medium it may be argued that the mass transfer between the dust-phase and the solid matrix is dependent on the wetted surface area of the REV and thus the mass transfer Γ is taken as

$$\Gamma = \nabla \cdot \left(\varphi \left\langle N^o \, N^o \right\rangle_\varphi \right) = \varepsilon \, S \tag{4.10}$$

Thus the dust-phase continuity equation (4.1) takes the form

$$\nabla \cdot \left(\varphi \, N_\varphi \, v_\varphi \right) = -\varepsilon \, S \,. \tag{4.11}$$

It should be emphasized at this point that the determination of the mass transfer coefficient ε that is postulated here to be a function of some quantities including the porosity rigidity of the medium should be experimental. When the particle distribution is uniform, i.e., dust particle number density N is taken to be constant through or when the dispersion of the dust-phase is not taken into account, then $\Gamma = 0$ and the dust-phase continuity equation reduces to the form

$$\nabla \cdot \left(\varphi \, N_\varphi \, v_\varphi \right) = 0 \,. \tag{4.12}$$

To this end, the averaged equations of the flow at hand are

The dust-phase equations given by

The continuity equation

$$\nabla \cdot \left(\varphi \, N_\varphi \, v_\varphi \right) = -\varepsilon \, S \tag{4.13}$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi\, \mathrm{v}_\varphi \mathrm{v}_\varphi\right) = \frac{k\varphi}{m}\left(u_\varphi - \mathrm{v}_\varphi\right). \tag{4.14}$$

The fluid-phase equations given by

The continuity equation

$$\nabla \cdot \left(\varphi\, u_\varphi\right) = 0 \tag{4.15}$$

and the linear momentum equation

$$\rho\nabla \cdot \left(\varphi\, u_\varphi\, u_\varphi\right) = -\varphi\nabla p_\varphi + \mu\nabla^2\left(\varphi\, u_\varphi\right) + \frac{1}{V}\int_S\left(-np^\mathrm{o} + \mu\, n\cdot\nabla u\right)ds \cdot \tag{4.16}$$

4.2 Analysis of the surface integral

The surface integral appearing in equation (4.16) contains the necessary information on the effect of the porous matrix on the flowing phases. Its accurate evaluation depends on the knowledge of the porous matrix structure and its geometric description. However, in the absence of a dust-phase partial pressure and a dust-phase viscosity the effect of the porous matrix on the flowing mixture arises in the form of the fluid-phase quantities only. In order to evaluate the surface integral $\int_S\left(-np^\mathrm{o} + \mu n\cdot\nabla u\right)ds$, one can write it in terms of the directional derivative along the unit normal vector as $\frac{1}{V}\int_S\left(-np^\mathrm{o} + \mu\frac{\partial u}{\partial n}\right)ds$.

This surface integral is imperative to provide an accurate description of the porous medium. Evaluation of a similar integral was addressed in [6] for the case of a single-phase flow in porous media, where they distinguish between consolidated and granular isotropic porous media. To take into account the effect of the porous microstructure on the flow, they introduced the concept of RUC which is defined as the minimal REV in which the average properties of the porous medium are embedded. By defining u_p to be the area average fluid-phase velocity at pore level in a stream wise oriented pore and R to be the product of the Reynolds number and the friction factor associated with the flow of a dusty fluid in a square duct (for consolidated media) or between parallel plates (for granular media) then the surface in equation (4.16) takes the form

$$\frac{1}{V}\int_S\left(-np^\mathrm{o} + \mu n\cdot\nabla u\right)ds = -\mu\, s\, R\, u_p/\tau. \tag{4.17}$$

The volumetric flow rate of the fluid-phase is defined by $q_1 = \varphi\,\tau\, u_p$ or $q_1 = \varphi\, u_\varphi$. Thus $u_p = u_\varphi/\tau$. Substituting for u_p into equation (4.17) yields

$$\frac{1}{V}\int_S\left(-np^\mathrm{o} + \mu n\cdot\nabla u\right)ds = -\mu\, s\, u_\varphi R/\tau V \cdot \tag{4.18}$$

If equation (3.2) is substituted into equation (3.3), one gets

$$V = \frac{V_\varphi}{\varphi} = \frac{\varphi \lambda^3}{\varphi} = \lambda^3 . \tag{4.19}$$

Upon substituting equations (3.4) and (4.19) into equation (4.18) one gains

$$\frac{1}{V}\int_S \left(- np^\circ + \mu n \cdot \nabla u\right)ds = -\left[3R(1-\tau)(3\tau-1)/\lambda\tau^3\right]\mu\, u_\varphi . \tag{4.20}$$

Now substituting equation (4.20) into equation (4.16) we obtain the following fluid-phase momentum equation $\rho \nabla$ that is valid in consolidated porous media

$$\rho \nabla \cdot \left(\varphi u_\varphi\, u_\varphi\right) = -\varphi\nabla p_\varphi + \mu\nabla^2\left(\varphi\, u_\varphi\right) - \left[3R(1-\tau)(3\tau-1)/\lambda\tau^3\right]\mu u_\varphi . \tag{4.21}$$

Furthermore, by substituting equations (3.4) and (4.19) into equation (4.16) we obtain the fluid-phase momentum equation that is valid in granular media

$$\rho \nabla \cdot \left(\varphi u_\varphi\, u_\varphi\right) = -\varphi\nabla p_\varphi + \mu\nabla^2\left(\varphi u_\varphi\right) - \left[6R(1-\varphi)^{2/3}/\lambda\tau\right]\mu u_\varphi \tag{4.22}$$

The dust-phase continuity equation (4.12) can be written with the help of equations (3.4) and (3.9) for consolidated porous media in the form

$$\nabla \cdot \left(\varphi N_\varphi\, \mathrm{v}_\varphi\right) = -3\varepsilon(1-\tau)(3\tau-1)\lambda^2/\tau^2 \tag{4.23}$$

while for granular porous media equation (4.12) takes the form

$$\nabla \cdot \left(\varphi N_\varphi\, \mathrm{v}_\varphi\right) = -6\varepsilon(1-\varphi)^{2/3}\lambda^2 . \tag{4.24}$$

To this end, we can summarize the governing equations:

For consolidated media:

The dust-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi N_\varphi\, \mathrm{v}_\varphi\right) = -3\varepsilon(1-\tau)(3\tau-1)\lambda^2/\tau^2 \tag{4.25}$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi\, N_\varphi \mathrm{v}_\varphi\right) = \frac{\varphi\, k}{m}\left(u_\varphi - \mathrm{v}_\varphi\right) \tag{4.26}$$

The fluid-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi\, u_\varphi\right) = 0 \tag{4.27}$$

and the linear momentum equation

$$\rho \nabla \cdot \left(\varphi\, u_\varphi\, u_\varphi\right) = -\varphi\nabla p_\varphi + \mu\nabla^2\left(\varphi\, u_\varphi\right) - \left[3R(1-\tau)(3\tau-1)/\lambda\tau^3\right]\mu u_\varphi \tag{4.28}$$

For granular media:

The dust-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi\, N_\varphi\, \mathrm{v}_\varphi\right) = -6\varepsilon(1-\varphi)^{2/3}\lambda^2 \tag{4.29}$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi \, N_\varphi \, v_\varphi \right) = \frac{\varphi \, k}{m} \left(u_\varphi - v_\varphi \right) \tag{4.30}$$

The fluid-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi \, u_\varphi \right) = 0 \tag{4.31}$$

and the linear momentum equation

$$\rho \nabla \cdot \left(\varphi \, u_\varphi \, u_\varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 \left(\varphi \, u_\varphi \right) - \left[6R(1-\varphi)^{2/3} / \lambda \tau \right] \mu u_\varphi . \tag{4.32}$$

4.3   The final form of the governing equations

For computational purposes equations (4.25) – (4.32) may be cast in terms of the volumetric flow rates of the phases involved by substituting $q_1 = \varphi \, u_\varphi$ and $q_2 = \varphi \, v_\varphi$ and the macroscopic number densities $n = \varphi \, N_\varphi$ and $n_d = \varphi \, N_{d\varphi}$. In this case the following governing equations are obtained

For consolidated media:

The dust-phase equations are

$$\nabla \cdot \left(nq_2 / \varphi \right) = -3\varepsilon(1-\tau)(3\tau-1)\lambda^2 / \tau^2 \tag{4.33}$$

$$\nabla \cdot \left(q_2 \, q_2 / \varphi \right) = \frac{k}{m} \left(q_1 - q_2 \right) \tag{4.34}$$

The fluid-phase equations are

$$\nabla \cdot \left(q_1 \right) = 0 \tag{4.35}$$

$$\nabla \cdot \left(q_1 \, q_1 / \varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 \left(q_1 \right) - 12R\mu q_1 \left[(1-\tau)/\lambda(3\tau-1) \right] . \tag{4.36}$$

For granular media:

The dust-phase equations are

$$\nabla \cdot \left(nq_2 / \varphi \right) = -6\varepsilon(1-\varphi)^{2/3}\lambda^2 \tag{4.37}$$

$$\nabla \cdot \left(q_2 \, q_2 / \varphi \right) = \frac{k}{m} \left(q_1 - q_2 \right) \tag{4.38}$$

The fluid-phase equations are

$$\nabla \cdot \left(q_1 \right) = 0 \tag{4.39}$$

$$\rho \nabla \cdot \left(q_1 \, q_2 / \varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 \left(q_1 \right) - 6R\mu q_1 \left[(1-\varphi\tau)/\lambda\tau\varphi \right] . \tag{4.40}$$

5.   Two-way interaction

Here we consider the case of two-way interaction approximations that in the case of dusty flow through porous media take into account the influence of the dust on the clean fluid. Assume that the fluid-phase affects the dust-phase and the dust-phase effect on the fluid-phase is not negligible, then the fluid-phase momentum is given by (2.4). Consider the flow of a fluid in an isotropic porous medium and assume

that the fluid contains a small bulk volume of dust particles. This same flow in free-space is governed by Saffman's gas equations [11] which are considered here for steady incompressible fluid flow in the following forms

The dust-phase equations are

The continuity equation

$$\nabla \cdot (N\mathbf{v}) = 0 \tag{5.1}$$

and the linear momentum equation

$$\nabla \cdot (\mathbf{v}\mathbf{v}) = \frac{k}{m}(u - \mathbf{v}) \tag{5.2}$$

The fluid-phase equations are

The continuity equation

$$\nabla \cdot u = 0 \tag{5.3}$$

and the linear momentum equation

$$\rho \nabla \cdot (uu) = -\nabla p + \mu \nabla^2 u + kN(\mathbf{v} - u) \ . \tag{5.4}$$

5.1 Averaging equations

The required set of equations are derived by adopting the intrinsic phase averaging procedure over the REV and applying the averaging rules (i) – (viii) which are given in section 3.3 to the governing equations (5.1) – (5.4). Consequently, the intrinsic averaged equations governing the flow of a dusty fluid in a porous medium in the case of two-way interaction are given by

The dust-phase equations are

The continuity equation

$$\nabla \cdot \left(\varphi \left\langle N_\varphi \mathbf{v}_\varphi \right\rangle \right) + \nabla \cdot \left(\varphi \left\langle N^{\mathrm{o}} \, \mathbf{v}^{\mathrm{o}} \right\rangle_\varphi \right) = 0 \tag{5.5}$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi \, \mathbf{v}_\varphi \mathbf{v}_\varphi \right) + \nabla \cdot \left(\varphi \left\langle \mathbf{v}^{\mathrm{o}} \, \mathbf{v}^{\mathrm{o}} \right\rangle_\varphi \right) = \frac{k\varphi}{m} \left(u_\varphi - \mathbf{v}_\varphi \right) \tag{5.6}$$

The fluid-phase equations are

The continuity equation

$$\nabla \cdot \left(\varphi \, u_\varphi \right) = 0 \tag{5.7}$$

and the linear momentum equation

$$\rho \nabla \cdot (\varphi \, u_\varphi u_\varphi) + \rho \nabla \cdot \left(\varphi \left\langle u^{\mathrm{o}} u^{\mathrm{o}} \right\rangle_\varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 \left(\varphi \, u_\varphi \right)$$

$$+ k\varphi N_\varphi (\mathbf{v}_\varphi - u_\varphi) + k\varphi \left\langle N^{\mathrm{o}} \mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}} u^{\mathrm{o}} \right\rangle_\varphi \tag{5.8}$$

$$+ \frac{1}{V} \int_S \left(-np^{\mathrm{o}} + \mu n \cdot \nabla u \right) ds \ \cdot$$

Equations (5.5) – (5.8) represent the intrinsic averaged equations governing the flow of a dusty fluid in porous medium.

The deviation terms in these equations and the surface integral in equation (5.8) contain the necessary information on the interaction between the phase present and the porous medium. In particular, the surface integral represents the effect of the porous matrix on the flowing mixture.

5.2 Analysis of the deviation terms

The deviation terms appearing in equations (5.5) , (5.6) and (5.8) have already been analyzed in section 4.1 while the deviation term $\left(\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi}\right)$ which appears in equation (5.8) is the difference between two dispersion vectors and arises from averaging the relative velocity vector $\mathbf{v} - u$. In order to analyze the term $\left(\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi}\right)$ we apply the averaging rule (ii) and obtain

$$\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi} = \left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right\rangle_{\varphi} - \left\langle N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi} . \tag{5.9}$$

Upon using rule (iii) to the right hand side of equation (5.9), we obtain

$$\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right\rangle_{\varphi} = \left\langle N^{\mathrm{o}}\right\rangle_{\varphi}\left\langle \mathbf{v}^{\mathrm{o}}\right\rangle_{\varphi} + \left\langle \left(N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}} \tag{5.10}$$

and

$$\left\langle N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi} = \left\langle N^{\mathrm{o}}\right\rangle_{\varphi}\left\langle u^{\mathrm{o}}\right\rangle_{\varphi} + \left\langle \left(N^{\mathrm{o}}u^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}} . \tag{5.11}$$

Thus equation (5.9) becomes

$$\begin{aligned}\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi} &= \left\langle N^{\mathrm{o}}\right\rangle_{\varphi}\left\langle \mathbf{v}^{\mathrm{o}}\right\rangle_{\varphi} + \left\langle \left(N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}} \\ &\quad - \left\langle N^{\mathrm{o}}\right\rangle_{\varphi}\left\langle u^{\mathrm{o}}\right\rangle_{\varphi} - \left\langle \left(N^{\mathrm{o}}u^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}} . \end{aligned} \tag{5.12}$$

The terms $\left\langle \left(N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}}$ and $\left\langle \left(N^{\mathrm{o}}u^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}}$ represent fluctuations of the average deviations of the averaged products over the REV. Because of the smoothing action of the averaging procedure, then these terms are individually negligibly small. Alternatively, they may be taken to be of the same order and hence their net effect $\left\langle \left(N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}} - \left\langle \left(N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}}\right)\right\rangle_{\varphi}^{\mathrm{o}}$ is zero. In either case with the help of averaging rule (ii) equation (5.12) takes the form

$$\left\langle N^{\mathrm{o}}\mathbf{v}^{\mathrm{o}} - N^{\mathrm{o}}u^{\mathrm{o}}\right\rangle_{\varphi} = \left\langle N^{\mathrm{o}}\right\rangle_{\varphi}\left(\left\langle \mathbf{v}^{\mathrm{o}}\right\rangle_{\varphi} - \left\langle u^{\mathrm{o}}\right\rangle_{\varphi}\right) . \tag{5.13}$$

To analyze the right hand side of equation (5.13) we consider the following cases:

Case 1: If the dust particle distribution is uniform and hence N is constant then $\langle N^o \rangle_\varphi = 0$ and the term $\langle N^o \mathbf{v}^o - N^o u^o \rangle_\varphi$ vanished. Furthermore, if the dispersion is negligible then clearly the dispersion vectors $\langle (N^o \mathbf{v}^o) \rangle_\varphi^o$ and $\langle (N^o u^o) \rangle_\varphi^o$ both vanish.

Case 2: If there are no abrupt changes in the averaged relative velocity vector in the porous medium and $\langle \mathbf{v} \rangle_\varphi$ and $\langle u \rangle_\varphi$ are sufficiently well behaved, then the difference $\langle \mathbf{v}^o \rangle_\varphi - \langle u^o \rangle_\varphi$ is sufficiently small and hence negligible.

Case 3: Since the hydrodynamic dispersion is negligible in dust gases, it is possible to drop out the relative dispersion vector under the premise that the fluid and dust phases only exert a drag force on each other.

Case 4: If non of the above conditions is satisfied, then we treat the dispersion as a diffusion process, expressed in terms of the product of a diffusion coefficient δ and a number density driving differential $\left(\langle N \rangle_\varphi - \langle N_d \rangle_\varphi \right)$ and thus we obtain

$$\langle N^o \mathbf{v}^o - N^o u^o \rangle_\varphi = \delta \left(\langle N \rangle_\varphi - \langle N_d \rangle_\varphi \right). \qquad (5.14)$$

Upon substituting equation (5.14) into equation (5.8) we get

$$\rho \nabla \cdot (\varphi \, u_\varphi u_\varphi) + \rho \nabla \cdot \left(\varphi \langle u^o u^o \rangle_\varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 (\varphi \, u_\varphi)$$
$$+ k\varphi \left[N_\varphi (v_\varphi - u_\varphi) + \delta \langle N_\varphi - N_{d\varphi} \rangle \right] \qquad (5.15)$$
$$+ \frac{1}{V} \int_S \left(-np^o + \mu n \cdot \nabla u \right) ds \cdot$$

Hence the averaged equations of the flow at hand are:

The dust-phase equations are

The continuity equation

$$\nabla \cdot \left(\varphi \, N_\varphi v_\varphi \right) = -\varepsilon \, \lambda \qquad (5.16)$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi \, \mathbf{v}_\varphi \mathbf{v}_\varphi \right) = \frac{\varphi k}{m} \left(u_\varphi - \mathbf{v}_\varphi \right) \qquad (5.17)$$

The fluid-phase equations are

The continuity equation

$$\nabla \cdot \left(\varphi \, u_\varphi \right) = 0 \qquad (5.18)$$

and the linear momentum equation

$$\rho \nabla \cdot (\varphi\, u_\varphi u_\varphi) = -\varphi \nabla p_\varphi + \mu \nabla^2 (\varphi\, u_\varphi)$$
$$+ k\varphi \big[N_\varphi (v_\varphi - u_\varphi) + \delta (N_\varphi - N_{d\varphi}) \big] \qquad (5.19)$$
$$+ \frac{1}{V} \int_S (- np^\circ + \mu n \cdot \nabla u)\, ds \cdot$$

5.3 Analysis of the surface integral

The surface integral appearing in equation (5.19) was analyzed in section (4.2) and it represents the effect of the porous matrix on the following phases. Its accurate evaluation depends on the knowledge of the porous matrix structure and its geometric description and takes the form

$$\frac{1}{V} \int_S (- np^\circ + \mu n \cdot \nabla u)\, ds = - \big[6R(1-\varphi)^{2/3} / \lambda\tau \big] u_\varphi \,. \qquad (5.20)$$

Substituting equation (5.20) into equation (5.19), one obtains the following fluid-phase momentum equation that is valid in granular porous media

$$\rho \nabla \cdot (\varphi\, u_\varphi u_\varphi) = -\varphi \nabla p_\varphi + \mu \nabla^2 (\varphi\, u_\varphi)$$
$$+ k\varphi \big[N_\varphi (v_\varphi - u_\varphi) + \delta (N_\varphi - N_{d\varphi}) \big] \qquad (5.21)$$
$$- \big[6R(1-\varphi)^{2/3} / \lambda\tau \big] \mu u_\varphi \cdot$$

We can now summarize the governing equations

For consolidated media:

The dust-phase equations are

The continuity equation is

$$\nabla \cdot (\varphi N_\varphi\, v_\varphi) = -3\varepsilon(1-\tau)(3\tau-1)\lambda^2 / \tau^2 \qquad (5.22)$$

and the linear momentum equation

$$\nabla \cdot (\varphi\, v_\varphi v_\varphi) = \frac{\varphi k}{m} (u_\varphi - v_\varphi) \qquad (5.23)$$

The fluid-phase equations are

The continuity equation is

$$\nabla \cdot (\varphi\, u_\varphi) = 0 \qquad (5.24)$$

and the linear momentum equation

$$\rho \nabla \cdot (\varphi\, u_\varphi\, u_\varphi) = -\varphi \nabla p_\varphi + \mu \nabla^2 (\varphi\, u_\varphi)$$
$$+ k\varphi \big[N_\varphi (v_\varphi - u_\varphi) + \delta (N_\varphi - N_{d\varphi}) \big] \qquad (5.25)$$
$$- \big[3R(1-\tau)(3\tau-1) / \lambda\tau^3 \big] \mu u_\varphi$$

For granular media:

The dust-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi N_\varphi \, v_\varphi \right) = -6\varepsilon(1-\varphi)^{2/3}\lambda^2 \cdot \tag{5.26}$$

and the linear momentum equation

$$\nabla \cdot \left(\varphi \, N_\varphi \, \mathrm{v}_\varphi \right) = \frac{\varphi k}{m} \left(u_\varphi - v_\varphi \right) \tag{5.27}$$

The fluid-phase equations are

The continuity equation is

$$\nabla \cdot \left(\varphi \, u_\varphi \right) = 0 \tag{5.28}$$

and the linear momentum equation

$$
\begin{aligned}
\rho \nabla \cdot \left(\varphi u_\varphi \, u_\varphi \right) = {} & -\varphi \nabla p_\varphi + \mu \nabla^2 \left(\varphi u_\varphi \right) \\
& + k\varphi \left[N_\varphi \left(v_\varphi - u_\varphi \right) + \delta \left(N_\varphi - N_{d\varphi} \right) \right] \\
& - \left[6R(1-\varphi)^{2/3} / \lambda \tau \right] \mu u_\varphi .
\end{aligned}
\tag{5.29}
$$

5.4 The final form of the governing equations

Following a similar procedure to that in section 4.3, we can now write down the final form of the governing equations for the two-way interaction case

For consolidated media:

The dust-phase equations (5.22) and (5.23) yield

$$\nabla \cdot \left(nq_2 / \varphi \right) = -3\varepsilon(1-\tau)(3\tau-1)\lambda^2 / \tau^2 \tag{5.30}$$

$$\nabla \cdot \left(q_2 \, q_2 / \varphi \right) = \frac{k}{m} \left(q_1 - q_2 \right). \tag{5.31}$$

The fluid-phase equations (5.24) and (5.25) are

$$\nabla \cdot \left(q_1 \right) = 0 \tag{5.32}$$

$$
\begin{aligned}
\nabla \cdot \left(q_1 \, q_1 / \varphi \right) = {} & -\varphi \nabla p_\varphi + \mu \nabla^2 \left(q_1 \right) \\
& + \frac{k}{\varphi} \left[n \left(q_2 - q_1 \right) \right] + \delta \left(n - n_d \right) \\
& - 12R\mu q_1 \left[(1-\tau) / \lambda(3\tau-1) \right].
\end{aligned}
\tag{5.33}
$$

For granular media:

The dust-phase equations (5.26) and (5.27) yield

$$\nabla \cdot \left(nq_2 / \varphi \right) = -6\varepsilon(1-\varphi)^{2/3}\lambda^2 \tag{5.34}$$

$$\nabla \cdot \left(q_2 \, q_2 / \varphi \right) = \frac{k}{m} \left(q_1 - q_2 \right). \tag{5.35}$$

The fluid-phase equations (5.28) and (5.29) become

$$\nabla \cdot \left(q_1 \right) = 0 \tag{5.36}$$

$$\rho \nabla \cdot \left(q_1 \, q_2 / \varphi \right) = -\varphi \nabla p_\varphi + \mu \nabla^2 \left(q_1 \right)$$
$$+ \frac{k}{\varphi} \left[n \left(q_2 - q_1 \right) \right] + \delta \left(n - n_d \right) \qquad (5.37)$$
$$- 6 R \mu q_1 \left[(1 - \varphi \tau) / \lambda \tau \varphi \right].$$

The hydrodynamic permeability of the flow may be defined in terms of the tortuosity that appearing in equations (3.30) and (5.33), which can easily be expressed in terms of the linear dimension of the RUC depending on the type of flow and the type of the porous media.

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Effects of Three Intervention Methods on Awareness of Psychological Implications of Female Genital Mutilation on Secondary School Female Adolescents in Ibadan

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Abstract: Despite the campaign against female genital mutilation (FGM) by both governmental and non-governmental organization in Nigeria, ignorance of its psychological implications, cultural tradition and religious beliefs of some people still make many to engage in this harmful traditional practice. This study therefore examined the effects of three intervention methods on awareness of the psychological implications Of Female genital mutilation on female secondary school adolescents in Ibadan. The non-equivalent pre-test-post test control group quasi-experimental designed was applied. Intervention programmes were conducted for the experimental groups using directs instruction, Bibliotherapy and group discussion methods. The Multi-stage random sampling technique was used to sample one thousand two hundred female adolescents in SSS I and II classes who were assigned to experimental and control groups. Intervention programmes were conducted for the experimental groups. Descriptive statistics of frequency counts were used for demographic data analysis while inferential statistic of analysis of covariance (ANCOVA) and Multiple Classification Analysis (MCA) were used to test the hypotheses at 0.05 alpha level. Based on the findings in the study, it was concluded that the intervention programmes have effect on the participants' levels of awareness of the psychological implications of FGM.

Introduction

Female genital mutilation (FGM) has been discovered to be a serious harmful traditional practice. FGM which is commonly known as "female circumcision", is a practice which involves the cutting off of part or whole of a girl's clitoris and some other parts of her ser organs whether for cultural or any other non-therapeutic reasons (WHO, 1997). It can be described as a cause of serious health hazard for the girl child or woman inflicting pain, trauma and body injuries (mutilation), it offers no benefit to anyone other than a misplaced sense of satisfaction (Thomas, 1988). The general reasons given as they appear in research papers, interviews and testimonial fall into four groups, these include psychosexual, religion, sociological and hygienic (Minority Rights Group Report, 1985).

Types of FGM currently practiced include:

Type I – excision (or reduction of prepuce with or without excision of part or all of the labia clitoris (Sunna).

Type II – excision of the clitoris and prepuce (clitoridectomy) together with partial or total excision of the labia minora.

Type III – excision of part or all the external genitalia and stitching or narrowing of the virginal opening (infibulation).

Health education intervention has been used in several studies in changing and improving people's awareness and attitude to health and health related issues (Mbizu, 1997; Miller, 1996; Lammers, 1996). They all reported that there was significant improvement in people's attitude towards different health issues concerned after intervention.

Some psychological implications of FGM include fear, anxiety, prolonged pain, anger, depression, fear for sexual intercourse, sexual dysfunction, strained marital relationship, long-lasting instability. Awareness of psychological implications of FGM will enhance its eradication in the society, because, the more informed people are on health issues, the more the level of precautions taken.

Improving peoples awareness of some implications of FGM is essential. This is because, ignorance of its health implications, cultural tradition and religious beliefs of some people still make them engage in this harmful traditional practice. This study therefore examined the effects of three intervention methods on awareness of psychological implications of FGM on secondary school female adolescents in Ibadan.

Hypotheses

In this study the following hypotheses were formulated and tested:

(1)   There is no significant effect of the three intervention methods on awareness of the psychological implication of pain cause by FGM on the secondary school female adolescents in Ibadan.
(2)   There is no significant effect of the three intervention methods on awareness of the psychological implication of phobia (fear) for sexual intercourse caused by FGM on secondary school female adolescents in Ibadan.

Methods and Procedure

Research Design: The non-equivalent pre test – post test control group of quasi-experimental design was used for this study. The choice of this design was made because, with the use of control group, the post – test changes were attributed to the effects of knowledge acquired after each of the three intervention training methods of group discussion (GD), direct instruction (DI) and Bibliotherapy (B) on the experimental groups.

Population: The population for this study comprised all secondary school female adolescents in Ibadan Municipal of Oyo State, Nigeria.

Sample and Sampling Techniques: The sample for this study comprised 1,200 adolescent females in the senior secondary school (SSS) I and II in four purposively selected secondary schools within each of the five local government areas L.G.A.) which make up Ibadan municipal of Oyo State. The purposive sampling technique was used to select four schools from the list of girls only and mixed schools in each of the five L.G.A., having exempted names of schools with only males.

The Multiple-stage random sampling technique was adopted to select thirty (30) female adolescents (respondents) from SS I and another 30 respondents from SS II, making a total number of 60 respondents from each sampled school. The sixty respondents in each school were assigned to a group. The four sampled school in each LGA formed four (4) different groups. Three of these groups formed the experimental groups on which each intervention method was used, while one formed the control group, thus making twenty groups in all.

Procedure for data Collection

The completed (pre test and post test) questionnaire were collated analyzed using descriptive and inferential statistics of frequencies and percentages were used to analyze Section A of the questionnaire which dealt with the demographic characteristics of respondents.

Section B of the questionnaire dealt with soughting information on respondents' level of awareness of psychological implication of FGM after the intervention training. The close-ended type of questionnaire design in line with Likert's scale techniques of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was used. The inferential statistics of Analysis of Covariance (ANCOVA)

used for intra-group pre test and post test comparison and also for comparison between post test values of the three experimental groups. Each hypothesis was tested at 0.05 alpha-level.

Procedure for Data Analysis

Responses from the completed (pre test and post test) questionnaires formed the basis of coding. The results of the findings collected from the structured questionnaires were grouped under the variables being investigated.

The data were collated, computed and analyse. The results were described in tables and discussed in two phases. The first phase presented the demographic characteristics of respondents using frequency counts and percentages. The second phase presented the results on effect of the three intervention methods on awareness of psychological implications of respondents towards FGM, using the descriptive statistics of mean, standard deviation and mean difference; the inferential statisticsa of ANCOVA and MCA.

Data Analysis and Discussion of findings
Table 1: Demographic Information of Respondents
N=1098

Variable	Category	Frequency	Percentage
Age Range	No response	98	8.9
	10-15 years	452	41.0
	16-20 years	525	48.5
	Over 21 years	18	1.6
Class:	No response	33	3.0
	SSS 1	606	54.9
	SSS 2	464	42.1
Local Govt. Area	No response	48	4.4
	Ibadan North	193	17.5
	Ibadan North East	112	10.2
	Ibadan North West	180	25.4
	Ibadan South East	183	16.6
	Ibadan South West	287	26.0
States of Origin	No response	17	1.5
	Oyo	721	65.4
	Osun	141	12.8
	Ogun	81	7.3
	Lagos	34	3.1
	Ondo	25	2.3
	Ekiti	42	3.8
	Abia	31	2.8
	Akwa Ibom	11	1.0

Total No = 1,098

Table 1 shows the Demographic information of respondents on:

(i)   **Age-range:** - 41% of respondents were between ages 10-15 years while 8.9% were between ages 16-20 years, 1.6% were over 21 years while 8.9% gave no response

(ii)   **Classes: -** the table shows that 54.99% of the respondents were in SS I, 42.1% were in SSII while 3% gave no response.

(iii)   **Local Government area of respondents' school:** - 17.5% of respondents were from schools in Ibadan North, 10.2% were from schools in Ibadan North East, 25.4% were from schools in Ibadan North West, 16.6% were from schools in Ibadan South East, 26% were from schools in Ibadan South West while 4.4% gave no response.

(iv) **State of Origin:** 65.4% of the respondents are from Oyo State, 2.8% are from Osun State, 7.3% are from Ogun State, 3.1% are from Lagos State, 2.3% are from Ondo State, 3.8% are from Ekiti State, 2.85 are from Abia State, 1% are from AwaIbom State while 1.5% gave no response.

Hypothesis 1

There is no significant effect of the intervention methods on awareness of psychological implication of pain caused by female genital mutilation (FGM) on secondary school female adolescents in Ibadan.

Table 2: Descriptive statistics on awareness of the psychological implication of pain caused by FGM on respondents.

Treatments	Post-Test		Pre-Test		Mean Gain	Number
	Mean	Standard Deviation	Mean	Standard Deviation		
Direct instruction (DI)	5.3110	2.4150	3.2155	1.1667	2.0955	283
Bibliotherapy (B)	4.7491	1.5927	3.4502	1.2249	1.2989	271
Group Discussion (GD)	5.9351	1.6746	3.9313	1.0947	2.0038	262
Control	4.4634	1.5276	3.7282	1.0820	0.7352	281

In Table 2 the values of mean gain for Direct Instruction (DI) method,

Bibliotherapy (B) Group discussion (GD) and control groups are positive. This indicates that the treatments given have effect on respondents level of awareness of the psychological implication of pain caused by female genital mutilation (FGM) since the pre test scores are lower than the test scores as seen in the table above.

Table 2 also shows that the post test mean scores of secondary school female adolescent (participants) exposed to each of the three intervention methods (DI, Band GD) on awareness of the psychological implication of pain caused by FGM are higher than the control group. This indicated that treatment which respondents had been exposed to was effective.

Table 3: Analysis of Covariance (ANCOVA) on Awareness of psychological implication of pain caused by FGM.

Source variation	Sum of Squares	Degree of Freedom	Mean Square	F cal	F cri	Sign of F
Covariates	9.810	1	9.810	2.903	3.85	0.089
Treatments	353.538	3	117.846	34.873	2.61	0.000
Explained	363.348	4	90.837	26.880	2.38	0.00
Residual	3710.481	1098				
Total	4073.830	1102	3.697			

To test whether the differences are significant, Table 3 which shows the results from analysis of covariance (ANCOVA) reveals a statistically significant difference among the respondents exposed to each of the intervention methods and controls groups[F (3,1098) = 34. 873; P< 0.05].

With this value of F, the decision was to reject hypothesis 1 (H₀ 1). This is because the F test at P< 0.05 shows significant differences exist among the four groups since the F cal is greater than the F cri. This means that there is significant effect of the three intervention methods on awareness of physiological implication of pain caused by FGM on respondents. In order to determine the magnitude and direction of the differences as well as the proportion of contribution of the methods on awareness of the

psychological implication of pain caused by FGM, Multiple Classification Analysis (MCA) used as presented in table 4.

Table 4:   Multiple Classification Analysis (MCA) on Awareness of psychological implication of pain caused by FGM According to Treatments.
Grand mean = 5.101.

Treatments	N	Unadjusted Deviation	Eta	Adjusted for independent + covariates Deviation	beta
Direct instruction	283	0.21		0.17	
Bibliotherapy	271	-0.35		-0.37	
Group Discussion	262	0.83		0.87	
Control	287	-0.64		-0.62	
			0.29		0.30
Multiple R Squared					0.089
Multiple R					0.299

The MCA in Table 4 shows a pattern similar to ANCOVA in Table 3. From the table, the control group (X_4) has an adjusted mean score 4.481 (5.101 – 0.62), the experimental groups i.e. GD (X_3) has the adjusted mean score value of 5.971 (5.101 + 0.87), while the experimental group 2 i.e. B (X_2) has the adjusted mean score 4.731 (5.101 – 0.37) and lastly, the experimental group 1 i.e. DI (X_1) has the adjusted mean score of 5.271 (5.101 + 0.17)

This result indicates that scores of GD is greater than DI, DI is also greater than B while control group scored lowest. This indicates that GD is the most effective method out of the three methods.

The ordering is $X_3 > X_1 > X_2 > X_4$. From the table, the multiple R^2 which shows a beta value of 0.089 shows that of all the variation of the post – test scores on awareness of the psychological implication of pain caused by FGM, 8.9% (0.089 x 100) was due to the differences in the intervention methods given. The findings in this study is supported by Cirillo (1988), that group discussion methods has the characteristics of having a strong effective and trust connotation and involves interaction between learner and teacher.

Hypothesis 2

There is no significant effect of the three intervention methods on awareness of psychological implication of phobia (fear) for sexual intercourse caused by FGM on secondary school female adolescents in Ibadan

Table 5:   Descriptive statistics on awareness of the psychological implication of fear for sexual intercourse caused by FGM.

Treatments	Post-Test		Pre-Test		Mean Gain	Number
	Mean	Standard Deviation	Mean	Standard Deviation		
Direct instruction	5.5583	2.5333	3.1060	1.1529	2.4523	283
Bibliotherapy	4.4133	1.9738	3.2731	1.6841	3.11402	271
Group Discussion	5.2328	1.6983	4.000	1.0898	2.2328	262
Control	4.1951	1.4617	3.5923	1.0332	0.6048	287

Table 5 shows the values of mean gain for DI, B, GD and control groups are positive. This indicated that the treatments given had significant effect on respondents' level of awareness of the psychological implication of fear for sexual intercourse caused by FGM since the pre test scores are lower than the post test scores as seen in the table above.

Table 5 also shows that the pre test means scores of respondents exposed to each of the three intervention methods (DI, B, GD) on awareness of the psychological implication of fear for sexual intercourse caused by FGM are higher than the control group. Form this findings, it can be inferred that treatment given o respondents in experimental group was effective.

Table 6: ANCOVA on Awareness of Psychological Implication of fear for sexual intercourse caused by FGM.

Source variation	Sum of Squares	Degree of Freedom	Mean Square	F cal	F cri	Sign of F
Covariates	566.355	1	566.355	121.870	3.85	0.000
Treatments	597.227	3	199.076	42.838	2.61	0.000
Explained	1163.582	4	290.896	62.596	2.38	0.000
Residual	5102.630	1098	4.647			0.000
Total	6266.212	1102	5.686			

The test whether the differences are significant, Table 6 which indicates the result from ANCOVA reveals a statistically significant difference among the respondents exposed to each of the intervention methods and control group [F (3,10980 = 42.838; P< 0.05]. with this value of F, the decision was to reject hypothesis 4. it could be inferred therefore that there was significant effect of the intervention methods on awareness of psychological of fear for sexual intercourse caused by FGM on respondents. This is because the F test at P< 0.05 shows significant differences exist among the four groups since the F cal is greater than the F cri. In order to determine the magnitude and direction of the differences as well as the proportion of contribution of the methods on awareness of psychological implication of fear for sexual intercourse by FGM, MCA was used as presented in table 7.

Table 7: MCA on Awareness of psychological implication of fear for sexual intercourse caused by FGM according to Treatments.
Grand mean = 5.336

Treatments	N	Unadjusted Deviation	Eta	Adjusted for independent + covariates Deviation	beta
Direct instruction	283	0.22		0.03	
Bibliotherapy	271	1.08		-0.97	
Group Discussion	262	-0.10		0.16	
Control	287	-1.14		-0.09	
			0.34		0.31
Multiple R Squared					0.186
Multiple R					0.431

MCA in table 7 shows a pattern similar to ANCOVA in Table 6. From the table, the control group (X_4) has an adjusted mean score value of 4.246 (5.336 – 1.09), the experimental groups 3 i.e. GD (X_3) has the adjusted mean score value of 5.496 (5.336 + 0.16), while the experimental group 2 i.e. B (X_2) has the adjusted mean score 6.306 (5.336 + 0.97) and lastly, the experimental group 1 DI (X_1) has the adjusted mean score of 5.336 (5.336 + 0.03). From this finding, it could be inferred that Bibliotherapy method was the most effective with GD next to it and then DI. The ordering is $X_2 > X_3 > X_1 > X_4$. From the table, the multiple R^2 which shows a beta value of 0.186 shows that of all variation the posttest scores on awareness of psychological implication of fear for sexual intercourse caused by FGM 18.60 percent (0.186 x 100) was due to differences in the intervention methods used. This implied that the intervention

training given was effective on all experimental groups. The findings of study is I agreement with that of Almroth (2001) who reported that research in Sudan has yielded information about the physical complications that men may experience as a result of FGM, these include penetration difficulties, penis wounds as well as other psychological and economic problems, therefore advocating for improving peoples awareness on FGM implications in order to discontinue FGM practice in our societies.

Conclusion

The findings in this study formed the basis of the conclusions:

(1) There was a significant effect of the three intervention methods on participant's level of awareness of the psychological implications of pain caused by FGM on secondary school female adolescents in Ibadan.

(2) There was a significant effect of the three intervention methods on participant's level of awareness of psychological implication of phobia for sexual intercourse caused by FGM on secondary school female adolescents in Ibadan.

Recommendation

On the basis of findings, the following recommendations are suggested.

- All concerned agencies such as the Ministry of Health, Religious Affairs, Ministry of Education, Family Health Association and Non-governmental organizations NGO) should educate the public on FGM issues and concerted efforts should be given to the public.
- The Ministry of Information, through mass media such as radio, television and newspapers, should have columns and programmes that deal with FGM issue both implicitly and explicitly.

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