SCOTTISH JOURNAL OF ARTS, SOCIAL SCIENCES AND SCIENTIFIC STUDIES

VOLUME 21, ISSUE II
AUGUST 2014

Articles

A Study of the Socio-Demographic Aspects of Fear of Crime in Akure, Nigeria

Ayoyo, Damilohun Damson.

Department of Sociology,

Adekunle Ajasin University, Akungba, Nigeria

Email: adamsayoyo@yahoo.com

Abstract

This study examined the socio-demographic aspects of fear of crime generated by high rate of reported cases of bank robbery in Nigeria since the last decade. Using the city of Akure as a laboratory, the study sought to determine level of fear of crime among bank customers on the basis of sex, age, education, occupation and income status. With the aids of questionnaire, purposive and accidental sampling techniques, two hundred and thirty-four (234) bank customers participated in the study. Using frequency distribution, cross-tabulation and chi-square analytical techniques, results suggested high rate of fear of crime irrespective of sex, age, educational level, occupation and income status of bank customers. Although findings suggested varying degrees of fear of crime among the socio-demographic variables tested, such variations were not significant by sex, age, educational level and income status of respondents. Empirical evidence revealed significant relationship between occupation and fear of crime. The study concluded that fear of crime as an aspect of criminological studies is subjective and moderated by individual safety and risk perceptions.

Keywords: Bank customers, Crime, Fear of crime, Nigeria, Socio-demographic Aspects

Introduction

Since the last decade, fear of crime has increasingly become the beginning of wisdom for many residents in Nigeria and failure to address the phenomenon, deepened by frequent cases of robbery, kidnapping, piracy and in recent time terrorism by Boko Haram has generated public outcry. This study investigated the socio-demographic aspects of fear of crime among bank customers in Akure, Nigeria where bank robbery incidence reached an alarming rate in recent years.

In Nigeria, bank robbery which involves entering a bank and obtaining money by threat of force is often carried out successfully with many people as victims. It is a form of robbery that has bank premises as its main target and falls within the remit of violent crime which has undermined economic activities and caused occasional bank closure against customers as robbers in extreme cases use dynamites to break through banks, thereby foreclosing debates about gaining entry to vaults.

Besides the negative economic implications, robbery imposes fear and moral panics on the society which further deepens the general sense of insecurity in Nigeria (Fakoya, 2008) caused by terrorism, militancy and kidnapping. This underscores Kershaw, Budd, Kinshott, Mattinson, Mayhew and Myhill's (2000) argument that armed robbery engenders greater fear in individuals than larger-scale and longer-term crimes such as dumping of sewage and chemicals into rivers and sale of under-tested pharmaceuticals. This study adds to extant literature on socio-demographic aspects of fear of crime since not many studies on fear of crime as an aspect of criminological research have been conducted in Nigeria.

Fear of Crime

Fear is a subjective variable and, according to Ditton, Bannister & Farrall (1999:83), it encompasses a confusing variety of feelings, perspectives and risk-estimation and means different things to different people. La Grange and Ferraro (1989) identified concrete and formless fear. Concrete fear refers to imminent danger while formless or abstract fear is more widespread, arising, for example, from reported crime through media or victimization surveys. Fear implies a state of anxiety or worry and, according to Maguire (1997), fear can become a 'Self fulfilling Prophecy' through heightened public awareness of crime.

The concept of fear of crime is nebulous. It is often viewed as the fear of being a victim of crime rather than the actual probability of being a victim of crime. Vanderveen (2006:4) cited two contrasting definitions. The first, provided by Conklin (1971) defines fear of crime as the sense of personal insecurity in the community. A subsequent proposal from Covington and Taylor (1991) suggests fear of crime is the emotional response to possible violent crime and physical harm, whilst Ferraro and LaGrange (1992, cited in Ferraro, 1995:4) opine that fear of crime is an emotional response of dread or anxiety to crime or symbols that a person associates with crime. This study provides rational and coherent account of fear of crime on the basis of some human socio-demographic characteristics.

Jackson (2006) argues that the modern idea of fear of crime is the manifestation of public attitudes and responses to crime. Public concerns about crime are indicated by territorial markings such as fences, no trespassing signs and external surveillance devices (Amzat et al., 2007). This view underscores Dambazau (1994) and Okoro (2001) position that the formation of neighbourhood security association and the installation of burglary proofs on windows and doors are strategies being taken by the public to protect themselves against falling victim of crime.

Lee (2007:136) avers that in modern crime prevention literature, fear of crime is as important objective of governance as crime itself. It has become part of the normal language of crime prevention and has been described by Garland (2001 cited in Lee, 2007:135) as a prominent cultural theme. The connection between crime prevention and fear of crime is highlighted by Crawford (1998), arguing that fear is actually inadvertently heightened by crime prevention strategies, as they

serve to remind people of their vulnerability and as a result, in societies where there is security threat, the fear of crime is alarming and all facet of public life is adversely affected (Amzat et al., 2007).

Jackson (2006) focus on the policy context of fear of crime; its imperatives and priorities, its focus and attention on issues and perspectives have shaped research and debate. Jackson explains that crucial to the development of fear of crime was the belief that crime was a problem and people believed that they were more at risk than before which was a reflection of changes and threats within society. According to Jackson, fear of crime developed from sociological investigation through crime surveys in tandem with increasing governmental interest in law and order. The foregoing suggests fear may be triggered by public concern about insecurity in the society.

In a study of Criminal Victimization and Safety Survey conducted between 2007 and 2009 in Nigeria by CLEEN Foundation, findings suggest fear of crime is far higher than victimization rate and people who are afraid of crime are virtually incapacitated. According to the report by CLEEN Foundation, fear of crime affects social relationships, economic activities, political stability and confidence in government and law enforcement agencies. The survey, which covered 10,228 respondents across the 36 states of Nigeria and Abuja, show an overall national figure of 86.6% of respondents expressing very high degree of fear. The survey indicates most of the respondents with high fear of crime resided in Gombe, Abuja, Plateau, Ebonyi, Ondo and Sokoto. While robbery was one of the most dominant forms of crime in which the respondents expressed fear, the high degree of fear among respondents results from loss of confidence in the ability of security agencies to protect them.

Lee (2007) avers that criminologists now recognize victimization as an important dependent variable within crime. This means that much can be learnt through the study of victims and their conduct and rather than being an element within the study of victimization, it is arguable that fear of crime has become an independent field. Whether or not an individual has been victimized, fear of crime can have several implications including decreased social integration, out-migration, restriction of activities, increased security costs and avoidance behaviours (Ferraro, 1995).

Vanderveen (2006:11) posits that since people constrain their daily activity patterns, fear of crime influences the quality of life. He also claims that those affected by this may succumb to social isolation or exclusion which may lower confidence levels and increase fear of crime. Vanderveen states further that fear of crime can have an adverse effect on health. This view is corroborated by Jackson (2006) who maintained that anxiety can harm a shared sense of trust, cohesion and social control within a community, and contribute to incidence of crime. The foregoing suggests that when crime becomes a source of public concern, it can impose fear on the general social lives of individuals and groups. On this note, this study hereby examines extant literature on factors influencing fear of crime.

Determinants of Fear of Crime

Studies have shown that the degree of fear of crime is determined by a number of factors. Allen's (2006) Home Office-funded report into the findings from two recent British Crime Surveys shows that in 2004/05, 4% more women than men have a high level of worry about burglary. Ramsay (1989) also found that while 71% of women were fearful of being mugged in Coventry, only 47% of men shared this anxiety. Jefferson and Hollway (2000) suggest that fear of crime means different things to men and women. While men are more likely to be most fearful of assault, women are more concerned about sexually-motivated attacks. Maxfield (1984:47) confirms that the differences in fear by sex and age are so substantial that something other than direct victimization experience must be involved.

Ramos and Andrade-Palos (1993) in a study in Mexico City found gender to be the clearest predictor for fear of victimization. Goodey (1997:401) claims that boys suffer from an emotional

vulnerability which triggers a form of masculine bravado or fearlessness. This causes boys to behave aggressively towards others and prompts the denial of vulnerability. An exception to this trend was confirmed by the BCS (2000 cited in Williams, 2004) where it was found that young men are more fearful of car-related theft. Lee (2007:116) stresses the significance of gender as an independent variable in fear of crime research. Lee submits that studies have repeatedly found women to be more fearful of crime than men and yet are less likely to become the victims of most categories of serious crime. This study however establishes role of sex in relation to fear of crime.

Moore and Shepherd (2007) acknowledge a shift in findings about fear and age. They claim that while previous research highlighted elderly people as the most fearful in society, more recent studies have started to report the opposite. Ramsay (1989) found a correlation between feelings of vulnerability and fear levels. Although older interviewees were less frequently victimized, respondents over age 60 were significantly more fearful of strangers' insults and muggings (Ramsay 1989:4). Older women were less fearful of sexual attacks than younger women, and were only marginally more fearful of being assaulted. Ramsay argues that the anxieties of the elderly were tempered by a degree of awareness that both assaults and sexual attacks typically involve comparatively youthful victims. Ramsay concludes by suggesting that elderly people are not so much at risk from crime as younger and more able-bodied people.

Skogan (1987:141 cited in Goodey, 2005:74) while reporting findings from surveys on fear of crime and victimization states that the environment or the context in which one finds oneself plays a large part in determining levels of vulnerability. Those who are alone (in any situation) are inevitably more susceptible to victimization as they represent a suitable target and lack the security of a capable guardian. This, together with the presence of a motivated offender, can result in a crime occurring, according to Cohen and Felson's (1979) Routine Activities Theory. The above suggests nearness to crime scene and failure to ensure safety may instigate public fear.

Research from Bursik and Grasmick (1993) and Sampson (1988, 1991) indicate residential stability increases the likelihood of social organization, cohesion and informal surveillance of the neighbourhood, all of which help prevent crime (Vanderveen, 2006:13). Crime rates are invariably higher in inner cities (The Chicago School) and one might expects city residents to be more fearful of crime. The British Crime Survey (2001) found that those living in inner-city and council estates and areas with high levels of victimization and social/physical disorder were generally more fearful. However, Silberman (1981, cited in Ramos & Andrade-Palos, 1993:43) argues that evaluation of personal safety is enhanced by familiarity with the surrounding area. Drawing from the above, the fact that most commercial banks in Akure are located in the inner city where commercial activities and businesses are concentrated may increase the chances of fear and victimization.

There has been a tendency to consider crime as an urban rather than a rural issue because rates are far lower in the countryside than the city (Yarwood & Gardner, 2000:403 cited in Wynne, 2008). This has resulted in focusing on fear of crime in urban areas. However, Yarwood and Gardner (2000 cited in Wynne, 2008) studied the fear of crime experienced in a village in Worcestershire. Their findings confirmed the consensus that those in the countryside are less fearful as they have less to fear. A massive 91% of respondents claimed they felt safe when home alone and more significantly 65% felt safe when walking alone after dark.

Ramsay's (1989) research offers an insight into social class as a predictor of fear of crime. Although members of the less-skilled/unskilled socio-economic groups interviewed had similar rates of victimization to the professional/managerial groups interviewed, the former groups were significantly more fearful of being insulted and mugged (Ramsay, 1989:5). The results show this to be paradoxical. An explanation for this could be that the less skilled/ unskilled individuals felt more vulnerable as they were more frequently exposed to dangerous environments and deviant people (neighbourhoods, work locations). Nevertheless, both groups shared high levels of fear, well above the actual rates of victimization, particularly for more serious offences. The BCS (2001) also

suggests that those who are less affluent live in social housing and those employed in unskilled occupations are more likely to be concerned about crime (Hancock, cited in Muncie & Wilson, 2004). Furthermore, BCS (2004 & 2005) findings revealed that fewer individuals with good educational qualifications worried about violent crime (11%) than those with no qualifications (20%).

In his contribution, Garland (2003, cited in Vanderveen 2006:149) argues that everyone has a unique risk thermostat, therefore, risk is not objective but produced, negotiated and manipulated within social interaction. This implies that perceived risk, defined by DuBow et al. (1979:3) as people's assessments of crime rates and the probability of victimization, represents an element of fear of crime which has eluded many studies. Ferraro (1995) feels that perceived risk plays a significant role in evoking fear, and highlights that in studies which include risk or perceived risk, it is influential in explaining fear of crime; suggesting that any scientific approach to the subject of fear of crime should give explicit attention to the risk interpretation process (Ferraro, 1995:7). However, Reid (2008 cited in Okunola 2009) argues that some fears are real and others are not.

In a study involving London taxi drivers by Mourato et al. (2004, cited in Vanderveen, 2006:10), it emerged that one-third of the drivers cited fear of crime as the most pressing issue affecting their jobs. This is supported by Crawford's (1998) view that crime is one of the principle anxieties shared by the public, second only to unemployment. Perhaps the biggest influence on fear of crime is public concern about neighbourhood disorder, social cohesion and collective efficacy (Perkins & Taylor, 1996; Wyant, 2008). The incidence and risk of crime has become linked with perceived problems of social stability, moral consensus and the collective informal control processes that underpin social order of a neighbourhood.

Similarly, Bannister (1993) maintains that day-to-day issues ('young people hanging around', 'poor community spirit', 'low levels of trust and cohesion') produce information about risk and generate a sense of unease, insecurity and distrust in the environment. Moreover, many people express, through their fear of crime, some broader concerns about neighbourhood breakdown, loss of moral authority, and the crumbling of civility and social capital (Girling et al., 2000; Farrall et al., 2009).

In a number of related findings, hearing about events and knowing others who have been victimized are thought to raise perceptions of the risk of victimization (Skogan & Maxfield, 1981; Tyler, 1980, 1984; Covington & Taylor, 1991). This has been described as a 'crime multiplier', or processes operating in the residential environment that would 'spread' the impacts of criminal events (Taylor & Hale, 1986). Such evidence suggests that hearing of friends' or neighbours' victimization may play a stronger role in anxieties about victimization than direct experience. There is a cautionary note that many residents of a neighbourhood only know of crime indirectly via channels that may inflate, deflate or distort the picture. A subject's criminal risk perception is exaggerated by peer-communication on crime and only moderated by the self experience (Rollinger, 2008).

With reference to fear of crime and the role of press in inducing it, literature uncovered the existence of a connection between crime, press coverage of criminal events and public opinion. In a pioneering study of four newspapers in Colorado, United States, to test the hypothesis that one, there is no consistent relationship between the amount of crime news in the Colorado newspapers and the state's crime rates; and two, public opinion about Colorado crime trends reflects trends in the amount of newspapers coverage than in actual crime rates, Davis (1952) presented evidence indicating that official crime rates and crime news coverage are unrelated, and that the public conception of crime reflects the picture of crime presented in the newspapers. This was further demonstrated by Cohen's (1972) study of how British papers exaggerated the 1964 'mods and rockers disorders' at some British seaside towns and the effect of the sensational reporting on the public, police and government.

Walklate (2007:88) argues that the growth in sensitivity to the fear of crime parallels the growth in sensitivity to the victim of crime more generally. She also states that such growth was boosted by media coverage of muggings in the early 1970s, and that rising recorded crime rates throughout this decade contributed to the introduction of the British Crime Survey (BCS) in 1982. This view correlates Garland (2001) who considered crime reporting by the mass media and in particular on television as a factor that had significantly altered social perceptions of crime. With the horrible news of crime in the print media, the public might perceive crime trend to be rising despite the opposite. This assertion is similar to the finding of Pfeiffer et al. (2005) in a study conducted in Germany where it was found that perception of increasing trend could generate perpetual fear of crime among the public. The study also found that these perceptions of rising crime are closely associated with preferences for stiffer sentences among the public, a situation which suggests media reporting has had an important influence on fear of crime.

Cohen (1972) presents evidence showing that owning to over-reporting of the disorders by the press, members of the public became worried, police activities increased and young people themselves created and joined gangs that were presented to them by the press as fashionable and exciting (Amzat et al., 2007). Fishman's (1980) study of how the press created a crime wave of crimes against the elderly in New York is another study detailing the relationship between sustained press reporting of criminal events and fear of crime. Fishman proved that the crime wave, which lasted for seven weeks, and was a major news theme in three daily newspapers and five local T.V. stations, in comparison with New York Police Department Crime Statistics for the period of time covered by the media crime wave showed that crimes against the elderly were not increasing.

Browne (1992) also advances the same position and showed the stages involved in how the press creates moral panics and crime waves. First, according to Browne, a small group of people commit some act of deviance then the media picks up on an 'interesting story' and produce headlines, stories, and photographs to interest readers and viewers. Such headlines would fascinate and draw the attention of readers, generate public debate and thereby attract more circulations. Second, to maintain reader's interest, original deviance is amplified through exaggerated and sensationalized reporting. Causes of the original deviance are simplified for easy explanation (such as lack of discipline by parents and teachers, decline in moral standards and so on). Third, the group are labelled as folk devils and stereotyping occurs through various appellations and historical descriptions of similar occurrence. This may lead to moral panic as public concern is aroused at the real or imaginary 'threat' to society; the media campaign for 'action' to be taken against this perceived threat and project reoccurrence. Lastly, more social control–politicians, police and magistrates respond to public demands as shown in the media, and law and order campaigns are begun to stamp down hard on the deviants. The public then wait anxiously for the outcome of the criminal justice system on the perceived 'epidemic' crime. In order words, crime reporting may stimulate criminal justice system to protect their image by taking drastic action in curbing the wave of criminalities (Browne, 1992).

In a similar vein, Dambazau's (1994) appraisal of crime news in Nigerian newspapers also gave credence to the relationship between crime reporting and the fear of crime among Nigerians. Dambazau highlighted the negative impact of this on the public, law enforcement agents and on the national economy. Another angle to the discourse is profit making motive as the reason why the press sensationalizes crime stories and ultimately heightens fear of crime among the public (Kirby et al, 1997; Soola, 2003).

Okunola (2009), in a study of fear of crime among commuters along Ibadan-Sokoto transport corridor in Nigeria, found that the general perception of safety, growing insecurity and media reportage are factors responsible for high rate of fear of crime in the country. Okunola findings showed that fear of crime in Nigeria has attracted public dimension.

Methodology

The study was conducted to gain knowledge on socio-demographic aspects of fear of crime among bank customers in Akure, Nigeria. Akure, a rapidly growing commercial and cosmopolitan city, plays host to a number of infrastructure and businesses including banks, government utilities, shopping malls, supermarkets, hotels and a total population of 360,268 (Nigeria Census figures, 2006 cited in National Bureau of Statistics, 2009:312).

Population and Sampling

The population for the study comprised both men and women bank customers who have or had bank accounts with commercial banks and resident in Akure. They include civil servants, traders, farmers, motorists and artisans. Using purposive and accidental sampling techniques, 234 respondents, comprising 139 men and 95 women participated in the study. The choice of purposive sampling was to ensure people with useful knowledge about study focus were selected. Accidental sampling technique was used to identify participants since sampling frame was not available. The sample location was demarcated into five zones: Alagbaka/Oba-Ile, Oba Adesida/Oyemekun, Okearo/Idanre road, Ijomu/Oke-Ijebu and Ondo road. The summary description of the study sample per selection zones is shown in table (1)

Table 1: Sample selection per zone

Zones	Respondents per sex		Respondents per occupation				
	Male	Female	Civil S.	Traders	Farmers	Motorists	Artisans
Alagbaka/Oba-Ile	33	38	55	9	-	3	4
Adesida/Oyemekun	51	17	5	45	-	7	11
Okearo/Idanre road	26	14	10	12	2	11	5
Ijomu/Oke-Ijebu	13	7	-	9	-	5	6
Ondo road	16	19	5	16	1	7	6
Total	139	95	75	91	3	33	32

Instrument

The study utilized questionnaire. A pre-test survey involving ten respondents was conducted to improve the validity and reliability of research instrument. 250 questionnaires were administered and 234 returned for analysis. The instrument sought to determine the degree of respondents' perceived fear of crime on the basis of their gender, age, education, occupation and income status.

Data Analysis

Using Statistical Packages for Social Sciences (SPSS), study data were analyzed using frequency distribution, cross tabulation, chi square and deductive reasoning. Cross tabulation was used to determine respondents' level of fear of crime on the basis of sex, age, education, occupation and income while chi square was used to test the significance of relationships between fear of crime and socio-demographic characteristics of respondents.

Results and Discussions

Sex and Fear of Crime

The study performed cross tabulation and chi square to determined fear of crime on the basis of sex, and results as shown in table (2) indicate that though there was general high level of fear of crime, greater percentage of female respondents expressed fear of crime and this support previous studies (Lee, 2007; Goodey, 1997) that women are more likely to be fearful of violent crime than men.

Table 2: Fear of crime and sex of respondents

Crosstabulation			
Sex	Fear of crime		Total
	Yes	No	
	%	%	%
Male	77.3	22.7	100
Female	86.7	13.3	100
Total	80.9	19.1	100
Chi square test			
	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson chi-Square	2.609	1	0.106

A further chi-square test shows that though some degree of relationship exists between sex of respondents and fear of crime, such relationship is not significant since P value 0.106 is greater than level of significance 0.05. This suggests there is no significant different in the level of fear expressed by respondents on the basis of their sex. In other words, the expression of fear of crime victimization among the bank customers in Akure was not significantly determined by whether they were males or females.

Age and Fear of Crime

The study also sought to determine the empirical relationship between age and fear of crime as table (3) depicts. Findings suggest greater percentage of bank customers between age (40 and 59) expressed fear of crime than other age categories. This also suggests the young and old adults are less fearful of crime than the middle aged adults. This fact is understandable given the fact that those between the ages of 40 and 59 are most likely to be at the prime of their careers with more at stake to lose. It was equally observed that younger women aged (20-39) were more fearful than younger men of the same age category. In all, findings suggest women are more fearful than men across all age categories.

Table 3: Fear of crime and age of respondents

Crosstabulation			
Age (in years)	Fear of crime		Total
	Yes	No	
	%	%	%
20-29	73.7	26.3	100
30-39	76.9	23.1	100
40-49	83	17	100
50-59	88.5	11.5	100
60 & above	100	0.0	100
Total	80.9	19.1	100
Chi square test			
	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson chi-Square	5.901	4	0.207

However, the chi-square test indicates P value of 0.207 which suggests that differential in the degrees of fear of crime expressed on the basis of age is not of significant proportion. The foregoing

implies the expression of fear of crime among respondents is not determined by their age group/category.

Education and Fear of Crime

The education level of respondents was tabulated against their expression of fear of crime and results indicate, as shown in table 4, greater percentage of respondents in each education category expressed fear of crime. Interestingly, those with no formal education and at least tertiary education expressed greater fear of crime than those with primary and secondary degrees of education, a situation which partially contracts BCS's (2004, 2005) findings that people with higher education level worry less than people with lower education level. This is because although findings of this study show a progressive decline in the degree of fear of crime expressed by respondents from primary to secondary levels of education, contrary to BCS findings, a progressive increase in the degree of fear of crime, as depicted in table 4, sets in from secondary and tertiary levels of education.

Table 4: Fear of crime and education level of respondents

Crosstabulation			
Education level	Fear of crime		Total
	Yes	No	
	%	%	%
No formal edu.	100	0.0	100
Primary	78.9	21.1	100
Secondary	77.3	22.7	100
Tertiary	82.5	17.5	100
Total	80.9	19.1	100
Chi square test			
	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson chi-square	2.204	3	0.531

A chi-square test was further performed and results show P value of 0.531, an indication that there is no significant difference in the degree of fear of crime expressed among respondents based on their level of education. In other words, the educational status of bank customers does not significantly determine the degree of their fear of crime. The foregoing suggests despite the fact that some levels of relationship do exist between level of education and expression fear of crime, there is empirical evidence that education may not be a significant determinant of fear of crime among bank customers in Akure.

Occupation and Fear of Crime

Table 4 shows data on occupation and degree of fear of crime. Findings suggest some degree of relationship between occupation and fear of crime. The cross tabulation results show greater percentages among civil servants and traders expressed fear of crime than drivers and artisans. The chi-square results show P value of 0.002 and suggest significant relationship between occupation and fear of crime. This empirical evidence indicates occupation may be a strong determinant of fear of crime among bank customers in Akure.

Table 5: Fear of crime and occupation of respondents

Crosstabulation			
Occupation	Fear of crime		Total
	Yes	No	

	%	%	%
Civil servants	83.6	16.4	100
Traders	90.9	9.1	100
Farmers	100	0.0	100
Motorists	61.5	38.5	100
Artisans	64.3	35.7	100
Total	80.9	19.1	100
Chi-square test			
	Value	Degree of freedom	Asymp. Sig. (2-sided)
Pearson chi-Square	17.082	4	0.002

It should be noted that the higher rate of fear of crime among civil servants and traders is understandable given the nature of their job which compel them to patronise banks and the fact that most of the civil servants and traders who participated in this study have their workplaces and businesses located in Alagbaka and Oba Adesida/Oyemekun zones which constitute the Central Business District (CBD) in Akure where most bank robberies often occur. This finding support previous studies (Skogan, 1987 and BCS, 2001) that those who work in inner cities are more fearful since they are more likely to experience more incidence of crime. This also suggests that degree of fear of crime may be closely associated with an individual's nearness to crime scene.

Income Status And Fear Of Crime

Table 5 shows findings on income status of respondents and fear of crime. Results suggest high expression of fear of crime across all income status categories with some percentage differential. Indication emerged that those with low monthly income express less fear of crime, a situation which points to some degree of relationship between monthly income status of respondents and their expression of fear of crime. The lower degree of fear of crime among respondents with low income may be due to the fact that low income earners are more likely to have low bank patronage since they may equally have less income to save in bank or lose in the event of bank robbery attacks.

A chi square test was performed to determine the relationship between level of monthly income and fear of crime and with a P value 0.105, results show income has no significant relationship on the expression of fear of crime among bank customers. In other word, the expression of fear of crime among bank customers is not significantly determined by whether they earned high or low income.

Table 6: Fear of crime and income level of respondents

Crosstabulation			
Monthly income Naira(#)	Fear of crime		Total
	Yes	No	
	%	%	%
Below 20,000	70.5	29.5	100
20,000-39,000	77.5	22.5	100
40,000-59,000	86.8	13.2	100
60,000-79,000	90.5	9.5	100
80,000-99,000	83.3	16.7	100
100,000 & above	100	0.0	100
Total	80.9	19.1	100
Chi-square test			
	Value	Degree of freedom	Asymp. Sig. (2-sided)

Pearson chi-Square	9.102	5	0.105

Conclusion

This study suggests high level of fear of crime victimization among bank customers in Akure. The study also points to the fact that fear of crime can be activated and aggravated in human public life irrespective of their sex, age, educational level and income status. The study suggests occupation to be strong determinant of fear of crime. Findings of this study indicate the extent of fear of crime is subjective to discreet individual risk perceptions which in some cases may transcend individual's sex, age, education, occupation or income status. By and large, the study shows empirical evidence that the degree of fear of crime is closely associated with an individual's nearness to crime scene.

In the final analysis, the study reaffirms Garland (2003 cited in Vanderveen, 2006) and Ferraro (1995) findings that fear of crime, as an aspect of criminological studies, is not objective but subjective, produced, negotiated and manipulated within social context.

References

Allen, J. 2006. Worry about Crime in England and Wales: Findings from the 2003/04 and 2004/05 British Crime Survey. Home Office Online Report 15/06, London: HMSO

Amzat, J., Abodunrin, A.J. & Okunola, R.A. 2007. The Print Media and Crime: Values and Issues. *International Journal of Criminal Justice Sciences* volume 2, issue 1

Bannister, J. 1993. *Locating Fear: Environmental and Ontological Security,* In H. Jones Ed.), Crime and the Urban Environment. pp. 69-84. Aldershot: Avebury

Browne .1992. *Deviance Amplification, Moral Panics and the Media*; in Kirby, M., Kidd, W, et al. *Sociology in Perspective*, Oxford: Heinemann Educational publishers.

Bursik, R.J. & Harold G.G. 1993. Neighbourhoods and Crime: The Dimensions of Effective Community Control. New York: Lexington Books.

CLEEN Foundation Report from the National Criminal Victimization and Safety Survey in Nigeria, 2007-2009

Cohen, L. & Felson, M. 1979. Social Change and Crime Rate Trends: A Routine Activity Approach, Folk Devils and Moral Panics. *American Sociological Review* 44 (4),   pp. 588–608

Cohen, S. 1972. *Folk Devils and Moral Panics*. London: Paladin.

Covington, J. & Taylor, R.B. 1991. Fear of Crime in Urban Residential Neighbourhoods: Implications of Between and Within: Neighborhood Sources for Current Models. *The Sociological Quarterly* 32.2: 231-249.

Crawford, A. 1998. Crime Prevention and Community Safety: Politics, Policies and Practices. Harlow: Pearson Education Ltd.

Dambazau, A.B. 1994. *Law and Criminality in Nigeria*, Ibadan: University Press Plc

Davis, J. 1952. Crime News in Colorado Newspapers. *American Journal of Sociology,* 57-66

Ditton, J., Bannister, J., Gilchrist, E. & Farrall, S. 1999. Afraid or Angry? Recalibrating the Fear of Crime. *International Review of Victimology* 6: pp.83-99

DuBow, F., McCabe, E. & Kaplan, G. 1979. *Reactions to Crime: A Critical Review of the Literature.* Washington: US Dept of Justice

Fakoya, O. Bank robberies in Nigeria. Nigerian village square, Saturday, May 17, 2008. www.google.com/article

Farrall, S., Jackson, J. & Gray, E. 2009. *Social Order and the Fear of Crime in contemporary Times'*. Oxford: Oxford University Press, Clarendon Studies in Criminology.

Ferraro, K.F. & LaGrange, R.L. 1992. Are older people most afraid of crime? Reconsidering age differences in fear of victimization. *Journal of Gerontology:* Social Sciences, 47, 233-244

Ferraro, K.F. 1995. *Fear of Crime: Interpreting Victimization Risk*, Albany: State University of New York Press

Fishman, M. 1980. Police News: Constructing an Image of Crime. *Urban Life* 9.4: 23-29.

Garland, D. 2001. *Culture of Control: Crime and Social Order in Contemporary Society*. Chicago: The Chicage University Press.

Girling, E., Loader, I. & Sparks, R. 2000. *Crime and Social Control in Middle England: Questions of Order in an English Town*. London: Routledge.

Goodey, J. 1997. *Boys Don't Cry:* Masculinities, Fear of Crime and Fearlessness. *The British Journal of Criminology* 37(3): pp.401-418

Goodey, J. 2005. *Victims and Victimolo*gy: Research, Policy and Practice, Harlow: Pearson Education Ltd

Jackson, J. 2006. Introducing Fear of Crime to Risk Research. *Risk Analysis* 26(1): pp.253-264

Kershaw, C., Budd, T., Kinshott, G et al. 2000. *The 2000   British Crime Survey*. London: HMSO

Kirby, M., Kidd, W. et al.1997. *Sociology in Perspective.* Oxford: Heinemann Educational.

Lee, M. 2007. *Inventing Fear of Crime: Criminology and the Politics of Anxiety*. Willan, Collumpton.

Liska, A.E., Joseph J.L. & Andrew, S. 1988. Fear of Crime as a Social Fact. *The Social Forces* Volume 60, Issue 3: pp. 760-770.

Maguire, M. Morgan eds. 1997. *Oxford Handbook of Criminology*. Oxford University Press, Oxford.

Maxfield, M.G. 1984. Fear of Crime in England and Wales. London: HMSO

Moore, S. & Shepherd, J. 2007. The Elements and Prevalence of Fear. *The British Journal of Criminology* 47(1): pp.154-162

Muncie, J. & Wilson, D. 2004. *Student Handbook of Criminal Justice and Criminology*. London: Cavendish Publishing Limited.

National Bureau of Statistics. 2009. Social   Statistics Report on 2006 Nigeria Census Report

Okoro, N. 2001. Media Perception of Local Government Administration in Nigeria: A Content Analytic Study. *Nsukka Journal of Humanities* Vol. 2:11:65-89.

Okunola, R.A. 2009. Commuters' Fear of Crime and the Road Transport Industry: A Study of Ibadan-Sokoto Transport Corridor. *Journal of the Nigeria Anthropological and Sociological Association (NASA)* volume 7, pp. 98-120

Perkins, D. & Taylor, R. 1996. Ecological assessments of community disorder: Their relationship to fear of crime and theoretical implications. *American Journal of Community Psychology* 24, 63-107.

Pfeiffer, C., Windzio, M. & Kleimann, M. 2005. Media Use and its Impacts on Crime Perception, Sentencing Attitudes and Crime Policy. *European Journal of Criminology*Volume 2 (3): 259–285.

Ramos, L.L. & Andrade-Palos, P. 1993. Fear of Victimization in Mexico. *Journal of Community and Applied Social Psychology* 3: pp.41-51.

Ramsay, M. 1989. *Downtown Drinkers: the perceptions and fears of the public in a city Centre*. Crime Prevention Unit Paper 19, London: HMSO

Reid, T. 2008. *Crime and Criminology* (11 Ed.). New York: McGraw Hill Higher Education

Rollinger, P. 2008. Experience and Communications as Explanations for Criminal Risk Perception. *The Brain-Gain Network E-Journal*. Available on the web

Skogan, W. 1987. Fear of crime and Neighbourhood Change. *Journal of Crime and Justice* Volume 8, pp. 203-229.

Skogan, W. & Maxfield, M. 1981. *Coping with Crime*. Beverly Hills: Sage

Soola, E.O, 2003. Coverage of Crimes and Violence in Nigerian Mass Media: Matters Arising. Paper presented at the National Conference of African Council for Communication Education, Nigeria Chapter.

Taylor, R.B. & Hale, M. 1986). Testing Alternative Models of Fear of Crime. *Journal of Criminal Law and Criminology* 77, 1, 151-189

Tyler, T.R. 1980. Impact of Directly and Indirectly Experienced Events: The Origin of Crime-related Judgements and Behaviours. *Journal of Personality and Social Psychology* 39:13-28

Vanderveen, G. 2006. *Interpreting Fear, Crime, Risk and Unsafety*. Netherlands: BJU Legal Publishers.

Walklate, S. 2007. *Imagining the Victim of Crime*. Maidenhead: Open University Press

Williams, K.S. Eds. 2004. *Textbook on Criminology*. Oxford: Oxford University Press

Wyant, B.R. 2008. Multilevel impacts of perceived incivilities and perceptions of crime risk on fear of crime. *Journal of Research in Crime and Delinquency* 45(1), 39-64.

Wynne, T. 2008. An Investigation into the Fear of Crime: Is there a Link between the Fear of Crime and the Likelihood of Victimisation? *Internet Journal of Criminology. Online*

Predicting math teachers' educational beliefs about teaching students with mathematical learning difficulties

Abdulhameed Said Hassan

Sultan Qaboos University, Oman

abhshk@squ.edu.om

Abstract

This study investigated math teachers' educational beliefs as a function of knowledge about academic characteristics, importance and use of teaching strategies, professional development, and teaching experience of pupils with learning disabilities. Participants were 106 Omani math teachers from Sultanate of Oman First - cycle schools. The participants responded to three questionnaires (Educational beliefs of math teachers, knowledge of academic characteristics, importance and use of teaching strategies) which were developed and used in the study. Results indicated greater teacher knowledge of academic characteristics, moderate importance of the sample using teaching strategies. Four independent variables: knowledge of academic characteristics, importance and use of teaching strategies and professional development collectively explained 88% of the changes occurring in educational beliefs of math teachers. Also, results revealed that there were statistically significant differences across the two independent variables in favor of teachers with a higher diploma in math learning disabilities.

Keywords: Math teachers' educational beliefs, teaching strategies, learning disabilities

Introduction

Changing the process of learning and teaching mathematics begins with transforming the perspectives that teachers carry with them regarding teaching mathematics acquired from their own educational experiences from the first grade to their professional teaching preparation programs. Research conducted by Beacham and Rouse (2012) and also Rouse (2008) found that the attitudes and knowledge of teaching candidates towards children with learning difficulties could be changed by exposing them to a chapter on integrating children with learning difficulties with normal children; therefore, studying teachers' attitudes and perceptions as a factor in teaching mathematics is a central concern in the literature on mathematical education. Literature on mathematical education continues to state that there is a statistically significant positive relationship between attitudes of teachers and their knowledge about the characteristics of learning disabilities and how to teach mathematics to students with learning disabilities (Forlin, 2004; Turnuklu & Yesildere, 2007; Wanger, Lee, & Ozgun-Kocka , 1999). Therefore the attitudes of teachers represent a collection of hidden assumptions about educational issues including the procedures of teaching and learning, curriculum, teaching methods and knowledge of student characteristics (Beswick 2005, 2008; Levin & Wadmany, 2006).

The positive attitudes that teachers carry with them heavily influence professional development and decision making regarding their own teaching methods and practice (Levin & Wadmany, 2006; Shahvarani & Savizi, 2007). According to empirical studies, the negative attitudes that teachers carry about teaching students with learning difficulties is considered one of the main obstacles in teaching these students (Kochhar, West, & Taymans, 2000; Mcleskey, Waldorn, So, Swanson, & Loveland, 2001). Additionally, some researchers believe that the teachers' own beliefs about teaching math to children with learning difficulties impacts their professional development. However, this knowledge is not only objective and relatively stable with a perceptual and structural nature (LederLeder & Crootenboer, 2005; Sahin, Bullock & Stables, 2002).

The results of several studies (Al-khatib 2007; Al-Natour, 1997; , Sideridis,Antoniou & Padeliadu,2008; DeSimone & Parmar, 2006; Paterson, 2007) highlight that math teachers have limited understandings regarding the needs of students with learning disabilities in math, and the professional preparation program given to teachers is not adequate to prepare them to teach this group of students. In order to "assist math teachers to sufficiently understand teaching methods and use the scope of their knowledge effectively, they should have opportunities and a number resources to expand and update their knowledge" (National Council of Teacher of Mathematics 2000, p 17). As a response to this approach, a number of countries have decided to implement new standards of content and methods for teaching math by 2001 (Woodward & Montague, 2002). As a result of this approach, a number of studies were conducted in order to focus attention on these standards. For example, several studies (Dowker, 2004;; Jordan, 2010; Kroesbergen & Van Luit, 2003; Thanheiser, Browning, Edson, Kastberg& Lo,2013) found a strong relationship between teachers' knowledge of methods and subject matter, and their success in helping student's to understand mathematics.

In spite of NCTM's efforts to define standards for teaching mathematics, there are still arguments against these standards among educators. This debate can be attributed to the fact that these standards do not take into account how teachers should assist students with special needs, or that students with learning difficulties were not considered in preparing these standards (Woodward & Montague, 2002). One study (Thompson, 2005) emphasized in its recommendations the need to encourage universities to train math teaching candidates to teach children with learning difficulties in their primary education, and to have a sufficient background in teaching methods for children with learning difficulties. Some studies pointed out that the failure of this group of children when learning math can be attributed to the failure of the weak strategies teachers use to solve math problems, or can be attributed to the fact that these problems are not appropriate for the age group of children (Geary, 2004). It is clear from these studies that most difficulties happen in the first cycle of basic

education (primary education) and it is not easy to find learning difficulties early. Additionally, the children who do not gain the required skills have trouble succeeding in their normal classes or on their exams (Bottge, 1999; Bryant, 2009). It is important to note that students discovered to have learning difficulties at an early age can attend intensive education that helps them to improve their abilities and in basic math skills (for example, the ability to classify and to distinguish between different quantities). In addition to these skills, students can learn placing value, estimation, and the ability to determine whether or not an answer is logical (Geary, 2004).

Many researchers examining learning difficulties in mathematics argue that students who have problems solving verbal math questions have a condition called 'Arithmetic Disability' or development dyscalculia. Many researchers attributed this problem to children having negative attitudes towards mathematics or arithmetic questions might not be of interest to them (Bull, Epsy, & Wiebe, 2008; Bulter, Beckingham, & Lauscher, 2005; Gonzalez & Espinel, 2002; Meese, 2001).

Other researchers attribute these learning difficulties to visual memory or cognitive disability (Bryant, 2005), while others attribute them to problems in verbal or working memory or short-term memory (Krawec, 2010; Stigler & Hiebert, 2004; Swanson & Jerman, 2007). In addition, they might be attributed to weaknesses in skills, such as not knowing numbers of operational quantity (Bos & Vaughn, 1998; Crutch & Warrington, 2001; Jitendra, Griffin, deatline -Buchman & Sczesniak, 2007), or difficulties in understanding and using the symbols and concepts of mathematics (i.e. one to one correspondence) (Davison & Neale, 1998; Morgan, Farkas, & Wu, 2009), or to learning mathematics in general or significant difficulties in understanding effective mathematic operations, in particular because of psychological problems (Montis, 2000). They might also be attributed to a weak understanding of arithmetic operations (like sum, subtraction, multiplication and division), or an inability to read and write numbers correctly (Shalev et al., 2001), or difficulties in defining mathematical symbols and remembering numbers by the strategy of counting fingers (Geary, 1993).

To solve the problem of reading in mathematics, Jones (2001) taught students a list of common words in mathematics for grades 1-6. Cawley, Foley and Miller (2003) suggested linking teaching mathematics to science by using appropriate educational strategies, modifying the curriculum, and integrating the skills of multiplication and division, ratio and proportion, color and work quantity, and some life issues into math and science education.

Jitendra (2002) suggests teaching students to solve math problems by making diagrams and representing information using storyboards according to the following steps: 1) determining the type of problem by reading it carefully and defining it; 2) representing the information on an information map; 3) defining the unknown quantity by a question mark; 4) getting suggestions for the solution; 5) solving the problem by using the appropriate mathematical operations. Moniuszko (1991) suggests introducing consumer activities for students who are scared of mathematics especially.

Hawkridge and Vincent (1992) point out that children who have simple learning difficulties can be helped by computers depending on the source of their disabilities (for example, using programs and new devices, or word processing programs). Alternatively, students with medium or severe learning disabilities can learn how to control a robot turtle through a program called logo. The logo program allows students to have an open ended educational environment which enables them to cultivate their thinking skills and to understand mathematical concepts; through these techniques, students can improve their self-esteem and become better learners (Clements & Battista, 1990). Sullivan and Lewis (1990, 2000) uses the tools of the keyboard and the logo program to achieve results in teaching math concepts (i.e. direction, counting, order, estimation, and angles), and in explaining the language of mathematics by providing written and audio instructions for students with medium and severe learning difficulties. Students are taught the angles of polygons through the method of designing them in the logo program. Maree (1992) suggests using holistic methods to treat students' weaknesses in mathematics and to study comprehension mistakes which arise from inadequate information and excessive generalizations.

In spite of the teaching skills that math teachers who teach students with learning disabilities have, their attitudes are influenced by a set of other factors. The most prominent of these factors is their previous experience and their personal epistemological approach. Initiating the required changes in teaching mathematics cannot be achieved without making teachers aware of their own teaching assumptions and encouraging positive attitudes towards education (Florian & Rouse, 2009; Levin & Wadmany, 2006; Shahvarani & Savizi, 2007).

Anderson, White, and Sullivan (2005) propose a model that addresses the influence on teachers' attitudes and methods using the following variables: mathematical knowledge, professional development, problem solving, students' educational characteristics, preparation programs for teachers and teaching strategies (2005, p. 18).

Research problem:

In spite of the efforts that The Ministry of Education has undertaken for children with learning difficulties to provide them with social educational services, strategies for teaching children with learning difficulties is still new. In addition, teaching mathematics to children with learning difficulties does not receive the expected level of attention for conducting research and policy making.

When searching ERIC database several years ago, the ratio of research on mathematics disabilities to reading disabilities was 5:1 for the decade 1996–2005 and 16:1 in the previous decade (Gersten, Clark, & Mazzocco, 2007). This creates demands on investigating remedial teaching strategies for students with learning difficulties in all subjects including mathematics (Stanberry & Swanson, 2009). Therefore, scientists have created strategies that help students interact with different requirements of the curriculum like solving mathematical problems (Deshler, Ellis, & Lenz, 1996).

The author himself has observed the experiences of teaching children with learning difficulties in schools located in Muscat in Oman. He has noticed that there are some failures in these aspects. In addition, a mathematical teacher who teaches this group of children complains about the absence of methods specialized for learning difficulties and not being aware of the characteristics of these types of learners. Also, there are no strategies and methods that teachers can use as a guideline when defining the weakness and strength of teaching children with learning difficulties. This was supported by Barkatsas and Malone (2005), Shahvarani and Savizi (2007), Stigler and Hiebert (2004). According to previous literature there is a considerable need to conduct research in this field and help answer the following questions:

What are the educational beliefs of mathematical learning difficulties teachers and their knowledge about the characteristics and strategies in teaching students with math learning difficulties?

Research Significance

This research is important because it addresses 'partial educational integration', one of the most prominent teaching strategies for students with special needs. Mixing and integrating children with special needs into class rooms with normal children requires special attention to teaching pedagogy, and specifically tailoring methods and expectations to students in order meet the individual needs of children with special needs. This method of integration is called the "individual education plan" and is the most common and prominent method used to teach children with learning difficulties.

Data collected from teachers themselves is the most important source upon which this teaching pedagogy is founded. It goes without saying that the success, knowledge, and experience of teachers who use the method will play an important role in the method's design. In the case of math education, developing strategies for teaching math essentially requires that the teacher first observes the rate at which his/her students are learning new material in relation to the difficulties the students

themselves face when learning arithmetic and secondly the degree to which math problems challenge students may also be related to the level of difficulty of the problems themselves (Imbo & Vandierrendonck, 2007).

Teachers are the most qualified group to assess the effectiveness of methods and teaching practices and the changes or development that can be achieved by applying these techniques. Additionally, teachers are aware of the characteristics and psychological traits used to diagnose learning difficulties, and specifically the challenges students with special needs face when learning through repetition, patience, recognizing relationships of degree, and identifying causes. Therefore, teachers play a prominent role in discovering and diagnosing learning difficulties in children and adding their experience to existing scientific scholarship (Torbeyns, Verschaffel & Ghesquiere, 2004).

The Salamanca conference statement of 2000 highlights principals and policies which should be used when educating children with special needs as well as the educational framework. Additionally, the Salamanca conference drew attention to the importance of preparing teachers to become influential for the educational philosophy for both university and secondary level education. The conference statement made the following suggestions:

1. The need to focus on building a program to prepare teachers before service in order to develop positive attitudes about children with special needs (educational belief).

2. The need to emphasize the skills and knowledge required for teaching children with special needs; skills which are also more broadly applicable for good teaching practice.

3. The importance of addressing the teacher's level of proficiency in dealing with children with special needs after certification to practice the profession.

4. The usefulness of organizing educational sessions for experienced principals and teachers and supporting them with written materials so that they can play a productive role in supporting and training less experienced teachers.

5. The need to integrate the teaching preparation program for teachers preparing to teach children with special needs and standard teaching preparation programs.

6. The significance of encouraging universities and institutions of higher education to conduct research and implement training programs that can support teachers of children with special needs.

7. Empowering the qualified disabled in educational systems to be a role models for others.

Building on these principles, there should be a preparation and training program for math teachers focused on meeting the needs of students with learning difficulties in mathematics as well as those who are recognized as disabled in general education. Additionally, steps should be taken to examine the challenges which these students face and put in place remediation methods to ensure that students with special needs do not fail simply because their teachers are unprepared to recognize the challenges they face and their learning (Smith, 2009). These sorts of effective teaching methods have grown in importance due to the successful application of strategies to engage and teach students with learning difficulties in mathematics.

From the principles of the Salamanca conference which emphasizes the importance of drawing upon the experience, knowledge and strategies of math teachers who teach students with learning difficulties and those who teach general education, this research addresses and analyzes the practical aspects, experience, and knowledge of teachers in order to highlight best practices, knowledge and methods used to teach children with learning difficulties in mathematics.

Purpose of the Study

1. Examine teachers' beliefs about the teaching of mathematics to children with learning disabilities in Oman.

2. Investigate how knowledgeable teachers of mathematics are about the academic characteristic of children with learning disabilities.

3. Investigate how much teachers of mathematics use a variety of methods and strategies when teaching mathematics.

Hypothesis

1. There is a significant correlation between sample individual means on math teachers' educational beliefs scale and their mean scores in knowledge about the characteristics of pupils with learning disabilities, importance and use of teaching strategies questionnaire, professional development and teaching experience questionnaire.

2. Scores on math teachers' beliefs about learning disabilities can be predicted by teachers' knowledge about the academic characteristics of pupils with learning disabilities, and the importance and use of teaching strategies, professional development and teaching experience questionnaire.

Methods

Participants

The participants in this study were 106 math teachers teaching children with learning disabilities grades (1-4) in Muscat First - cycle public schools in Oman: 38 female teachers with Higher Diploma in math learning disabilities and 68 female math teachers with a Bachelor in math teaching students with learning disabilities. The sample represents almost 28% of the total population of children (390); 44 with a Higher Diploma in learning disabilities, 346 with a Bachelor in math.

Instruments

Educational beliefs about math teachers' questionnaires: To identify the beliefs of teachers about integrating students with math learning disabilities with ordinary students, the following questionnaires have been utilized (Beswick, 2008 Beswick, 2005; DeSimone & Parmar, 2006; Fennema, Carpenter, & Loe, 1990). To achieve the aims of the research, only the second dimension of this scale was chosen which concerns the beliefs about integration only after making the modifications that meet the characteristics of students in the first cycle in Oman. According to Sahin et al. (2002, p. 37) and others, teachers' beliefs are understood as teachers' ideas and their interpretations of their work which include: their feelings, attitudes, experiences and decisions. However, the educational beliefs of the teachers are a group of hidden hypotheses towards educational issues like: the producers, method, school and knowledge (Levin & Wadmany, 2006, p. 159). The scale used in this study emphasizes the educational beliefs of teachers from three dimensions:

1. Teachers' beliefs regarding students with learning disabilities (SLD) which includes the following two items: SLD should be afforded every opportunity to learn math with general education students, and SLD are best taught math in an inclusive classroom.

2. Teachers' beliefs about Implementing Inclusion, which includes the following two items: for the most part, primary schools are effectively implementing inclusive programs, and SLD will have a better chance in society learning math in inclusive classrooms than resource rooms.

3. Resource rooms are effective in meeting the math learning needs of SLD, which includes the following four items: beliefs about roles and responsibilities of the general educator, general

education teachers are responsible for modifying instructions for SLD, general education teachers are responsible for ensuring that SLD succeed academically, and SLD causes the most behavioral problems.

The teachers responded on a five point rating scale (Strongly agree, Agree, Undecided, Disagree, Strongly disagree). This scale has high reliability and validity. The validity was determined in two ways: validity of expert and validity of teachers examined in a pilot study of 27 male and female teachers. The current study also examined the validity of experts, concurrent validity through the application of the scale which was developed by Beswick (2005) and consists of 26 items using a five point rating scale (strongly agree, agree, undecided, exhibitions, shows strongly). The scale was prepared in order to examine the teachers' beliefs about the role of the teacher and the nature of mathematics, and learning and teaching. The current study was limited to the beliefs associated with the learning and teaching of mathematics and item number ten. The reliability using Cronbach's alpha was 0.09. In this study the validity of experts and the reliability was found also using Cronbach's alpha of .88.

Teacher's knowledge of academic characteristics of SLD: This questionnaire helps teachers of math to identify the academic characteristic of students with math learning disabilities. The researcher benefited from previous studies (Al-Natour, 1997 ; DeSimone & Parmer, 2006). Through the pilot study which was applied with SLD (25 male and female students), this questionnaire includes 20 academic difficulties in mathematics using a five point scale ranging from 1 (not at all important) to 5 (very important). The validity of the questionnaire was examined using panel validity from teaching methods in math, and the reliability, using Cronbach's alpha, was .91.

Teacher's knowledge of strategies to teach SLD in math: A questionnaire has been designed and contained (28) methods or strategies to teach SLD in math. Books, literature and research on this aspect were found (Abu Nian; 2001; Bender, 2000; Furner,Yahya& Duffy,2005; Imbo & Vandierrendonck, 2007; Meese, 2001) and the questionnaire is filled with specific choices such as very large use, large use, medium use, weak use, very weak use. The validity of this questionnaire has been examined by a panel of four faculty in the curriculum and methods department in Sultan Qaboos University and the reliability, using Cronbach's alpha, was found (.83), and the test-retest reliability on a sample size of 25 teachers with an interval of two weeks was .80.

The results and interpretation

To answer the first question, the means and standards deviations were examined for the three dimensions as shown in Table 1.

Table 1
Mean, SD, & Level of teacher's beliefs

Dimension	mean	SD	level of teacher's belief
Beliefs About Including SLD	3.8868	.81147	high
Beliefs about Implementing Inclusion	4.1006	.62432	high
Resource rooms are effective in meeting the math learning needs of SLD	3.9906	.64317	high
Total	3.8619	.80920	high
1.79-1 very weak, 2.59-1.80 weak, 3.39-2.60 medium, 4.19-3.40 high, 5-4.20 very high			

It is clear from Table (1) that teachers' beliefs in teaching math to SLD is high for each dimension and for the total.

To answer the second question about teachers' knowledge of learning disabilities regarding the academic characteristics in math, the means and standard deviations were found for each difficulty as shown in Table 2.

Table 2

Means (M) and Standard Deviations (SD) of teachers' knowledge of academic characteristics student with math learning disabilities

Statement	Knowledge	
	M	SD
Distinguish between similar numbers like (17-71)	4.00	1.02
Understand the meaning of a number (for example what does number 5 or 4 mean)	3.97	1.04
Distinguish between the basic symbols of arithmetic (-,+,x,/)	3.97	1.19
Place the number in the cell of ones, tens, hundreds	3.89	1.12
Solving some verbal questions	3.88	.99
Distinguish between different geometric shapes (triangle, square, rectangle)	3.83	.95
Doing some basic multiplication and division operations	3.82	1.02
Finding double the number or half or a third	3.82	1.04
Pronunciation and writing two-digit numbers and three numbers	3.82	1.12
Questioning the meaning of zero when making calculations (eg: 0 +5 =0)	3.82	1.10
Solution to algorithms	3.81	1.07
Grasp the meaning of the fraction	3.79	1.11
Calculating multiplication and combining together in the same matter	3.71	1.05
Terms realize the possibilities (such as always - possible - sometimes – impossible)	3.70	1.12
Remember the laws of conversion units	3.66	1.09
Incomplete pattern	3.66	.99
Remember information presented VPL in a short period of time	3.65	1.07
Calculating numbers vertically and horizontally	3.65	1.15
Find a relationship between the denominations - and time units - units of length - mass units	3.57	1.19
Distinguish between types of lines in math (straight - a broken line - curve	3.51	1.03
Total	3.55	0.70

Table (2) shows that the combined mean for the level of teacher knowledge regarding math learning disabilities was 3.55 with a standard deviation of .70 indicating great teacher knowledge about the academic characteristics of math.

To answer the third question about math teachers' use of a variety of methods and strategies when teaching mathematics, the means and standard deviations were found for each disability as shown in Table (3).

Table 3

Means and Standard Deviations of the math teachers' use and importance of a variety of methods and strategies when teaching mathematics.

Use level		Method or strategy in teaching	Importance level	
M	SD		M	SD
4.25	.33	Learning by discovery	4.29	.52
4.12	.32	Method of distribution to groups in the teaching division	4.62	.42
4.20	.32	Pyramid Method	4.05	.73
4.10	.36	Method vehicles in the train reading the numbers from five homes	4.24	.92
3.71	.37	Method of gradual slowdown schedule	4.04	.39
3.69	.37	Missing factor Strategy	3.92	.36
4.06	.39	Analysis tasks Strategy	4.03	.71
4.05	.40	Line Numbers Strategic	4.32	.43
4.08	.41	Using numbers to represent the values of tangible Strategy	4.17	.51
4.09	.45	The use of peace in the collection numbers Strategy	3.98	.72
3.63	.46	The use of circles in reading numbers Strategy	3.95	.38
.683	.46	Reversal of numbers Strategy	4.23	.37
.653	.48	Method of distribution to groups in the teaching division	3.96	.62
.3.69	.49	Top-down method (all to the part)	4.05	.39
3.21	.43	Method upward (part to the total)	3.73	.74
3.27	.49	Trilling verbal strategy	3.74	.60
.143	.50	Exchange roles strategy	3.74	.37
.033	.50	Lattice strategy	3.34	.19
3.03	.33	Self – Talk strategy	3.32	.23
.023	.50	The strategy of using fingers in the process of multiplication table	3.99	.48
3.01	.50	Equity strategy in the multiplication table	3.85	.83
.013	.32	Strategic circles in the multiplication table numbers	3.02	.54
.002	.44	Comprehensive approach	3.52	.47
.731	.84	Keyboard and tortoise mechanism and Logo	2.83	1.05
.611	.81	Strategy (Carlson and Carlo) issues verbal	2.56	.94
.091	.89	Moniuszko Strategy	2.65	.93
.061	.94	Strategy (Cass Ital.) issues verbal	2.31	.74
.051	.93	Holistic Strategy	2.08	.83

It appears from Table 3 that the combined mean for the significance of using the strategies is 3.10 with a standard deviation of .85 indicating moderate importance for the sample of using teaching strategies. The means for each strategy ranged between moderate and high, except for five strategies: Carlson and Carlo, Moniuszko, Keyboard and tortoise mechanism and Logo, Cass Ital, Holistic, and the comprehensive approach which were all low in both significance and use.

Test Results for First Hypothesis:

To test hypothesis one, Pearson's Correlation Coefficient were computed on the sample scores (n=106) to assess the relationships between teachers' beliefs, knowledge, importance and use of strategies regarding SLD, professional development, and teaching experience. The results were as follows:

Table 4

Correlation coefficients between the scores of educational beliefs and independent variables

Independent variables	Correlation coefficient(r)	Degrees of freedom(r2)	Size effect
Knowledge of the academic characteristics of pupils with learning difficulties	0.494	104	large
The use of teaching strategies	0.908	104	large
The importance of using strategies	0.722	104	large
Professional development	0.723	104	large
Teaching experience	0.168	104	small

(r= 0.10, r = 0.30, r = 0.50) represent the effect sizes (small, average, large), respectively (Cohen, 1988, p. 83)

Table 4 shows a significant positive correlation (.001) between knowledge of academic characteristics, use of strategies, significance of strategy use and professional development with teachers' beliefs. Additionally, there was a significant positive correlation between the sample scores on teaching experience and the teachers' beliefs.

Test Results for Second Hypothesis:

To test the second hypothesis, Simple Regression Analysis and Multiple Regression Analysis were conducted to investigate if teachers' beliefs could be predicted by their knowledge, importance and use of strategies for SLD, professional development, and teaching experience. The results were as follows:

Table 5

Simple linear regression between beliefs and independent variables

Independent variables	regression coefficient(r)	coefficient of determination (r2)	t-value
Knowledge of the academic characteristics of pupils with learning disabilities	0.179	0.205	*4.721
The use of teaching strategies	0.689	0.776	*12.774
The importance of using strategies	0.130	0.175	*2.61
Professional development	0. 11	0.183	*2.216
Teaching experience	0.023	0.037	0.643

*P < .05

Table 5 shows that a change in 1 unit of knowledge about characteristics results in a change of .179 in teachers' beliefs, which explains .205 of the changes occurring in teachers' beliefs. Moreover, a change in 1 unit of the use of teaching strategies results in a change of .689 in teachers' beliefs, which in turn illustrates .776 of changes in teachers' beliefs. In addition, a change in 1 unit of Professional development variable causes a change of about .110 in teachers' beliefs, illustrating about .183 of changes occurring in beliefs. As for teaching experience, results indicate a weak influence. In light of these findings, significant variables were listed by their significance, as shown in Table 6.

Table 6

multiple linear regression between beliefs and independent variables

Independent variables	B	Std.error	t	Sig.	r2	F
	- 0.686	0.215	- 3.169	0.002		
Knowledge of the characteristics of pupils with learning difficulties	0.205	0.059	13.038	0.000		
The use of teaching strategies	0.767	0.390	3.867	0.000	0.879	191.51
The importance of using strategies	0.184	0.066	2.789	0.000		
Professional development	0.181	0.082	2.201	0.030		

As seen from Table 6, the coefficient of determination is 0.879 with a level of significance at .001. Therefore, the four independent variables: knowledge, use and importance of teaching strategies and professional development collectively explain 0.879 of the changes occurring in teachers' beliefs. The "F" value of the model was 191.513, with a level of significance at 0.000. Hence, 88% of the total variance in teachers' beliefs can be interpreted in light of all these variables.

Knowing that there is a statistically significant difference between math teachers who have a diploma and bachelor degree, the differences (educational beliefs, using teaching strategies) are presented in Table (7).

Table 7

Results of the Independent Samples t-tests to compare teachers with a diploma and a bachelor on the educational beliefs and independent variable

Variable	Diploma ($n = 38$)		Bachelor ($n = 68$)		t	Cohen's d
	M	SD	M	SD		
Education belief of teacher	3.85	.58	3.42	.81	4.36*	.61
The use of teaching strategies	3.95	.67	3.44	.89	4.45*	.65

Discussion of the results

It is clear from the results that the mathematics teachers in the sample use special methods specifically designed for this group of students with an acceptable percentage, except for some important strategies mentioned in Table (1). Notably, most teachers in the sample had no previous knowledge about these strategies and did not learn them during their university studies. They have gained these strategies by attending training courses during their services and through self-effort.

It is worth mentioning that the teachers in the sample directly or indirectly use other ways and methods to remediate learning difficulties. Some of these methods are quite appropriate especially the hierarchical methods, using a computer, telling stories during teaching, brainstorming and task analysis. These results can be accepted because they agree with the results of studies and research conducting on the same subject. Much research at the beginning of the first decade of the twenty first century focused on illuminating the ways to develop strategies for solving arithmetic and using strategies of simple counting through finger counting (Geary, Hamson & Hoard, 2000; Jordan & Hanich, 2000). The results of this study also agree with Steedly, Dragoo, Arefeh and Luke (2008) who highlight the fact that there is no one teaching method that is appropriate for all students in all situations.

The absence of significant differences among teachers when using teaching methods in light of teaching experience might be attributed to their participation in similar courses during in-service training by educational directorates or training directorate in the Ministry of Education in Oman. This finding is similar to the results of Yates (2007).

As for professional development to improve teachers' educational beliefs in mathematics, the results are consistent with a model (Anderson et al.,2005; Kuyini & Desai, 2007; Raymond, 1993; Wilson & Cooney, 2002) which emphasizes the interrelationships between factors associated with

beliefs and practices (professional development) of teachers, and results (de Vries, Grift, & Jansen, 2014,339) "Which indicates that "Teacher Continuing Professional development (CPD) can improve teach Quality and teaching practice". The results of the current study disagreed with Yates (2007) who found no significant relation between math teachers' beliefs and their academic qualifications.

Recommendations:

1. Encourage educators and researchers to devote more attention to the challenges of teaching and learning mathematics, and work together in identifying these difficulties and knowing how to deal with them in school and at home. Such collaborative efforts will help to remediate these difficulties in the primary grades of school and avoid the possibility of becoming serious problems in later grades.

2. Use multiple methods for teaching children with learning difficulties in mathematics by using contextual situations and experiences intended to facilitate their understanding and applications of addition and subtraction (Ostad, 1998, p. 3).

3. Train teachers to use hands-on applications in place of relying exclusively on mental strategies.

4. Encouraging higher educational institutions to provide the student teacher with math strategies for learning disabilities. Research-based strategies for helping students learn mathematics and being confident in their ability to perform the subject increase daily (Awofala, Olagunju& Fatade, 2012). There is an urgent need for teachers to shift from traditional methods of teaching students with math learning disabilities to contemporary teaching strategies.

References

Abu Nian, I. S. (2001). Learning disabilities teaching methods and cognitive strategies, Saudi Arabia, Riyadh, Arab Academy for Special Education.

Al-Katib, J.(2007). A Survey of general education teachers Knowledge of learning disabilities in Jordan, *International Journal of special Education,22*(1),72-76.

Al- Natour, M.(1997). An investigation of teacher knowledge about students with learning disabilities in Jordan and their teaching strategies during mathematic instructional Dissertation presented to the faculty of graduate college of University of Nebraska..

Anderson, J., White, P., & Sullivan, P. (2005). Using a schematic model to represent influence on, and relationship between, teachers' problem solving beliefs and practice. *Mathematics Education Research Journal, 17*(2), 9-38.

Awofala, A. O. A., Olagunju, A. M., & Fatade,A. O. (2012). Teachers' perception of the new Nine-Year Basic Education Mathematics Curriculum in Nigeria. *International Journal of Mathematics Trends and Technology,3*(1), 1-6.

Barkatsas, A., & Malone, J. (2005). A typology of mathematics teachers' beliefs about teaching and learning mathematics and instructional practices. *Mathematics Education Research Journal, 17*(2),69-90.

Beacham,N., & Rouse, M. (2012). Student teachers' attitudes and beliefs about inclusion and inclusive practice. *Journal of Research in Special Education, 12*(1), 3-11.

Bender, W. N. (2000). Learning disabilities: Characteristics, identification and teaching strategies. Boston MA: Allyn & Bacon.

Beswick, K. (2008). Influencing teachers' beliefs about teaching mathematics for numeracy to students with mathematics learning difficulties. *Mathematics Teacher Education and Development, 2007/2008, 9*, 3-20.

Beswick, K. (2005). The beliefs /practice connection in broadly defined contexts. *Mathematics Education Journal, 17*(2), 39-68.

Bos, C. S., & Vaughn, S. (1998). Strategies for teaching students with learning and behavior problems (4th edition).Needham Heights, MA: Allyn & Bacon.

Bottge, B. A. (1999). Effects of contextualized math instruction on problem solving of average and below-average achieving students. *The Journal of Special Education 33*, 81-92.

Bryant,D. P. (2009). Working with your child's teacher to identify and address math disabilities. Retrieved from: http://www.ldonline.org/article/34659.

Bryant, D.P. (2005). *Extending tree models to split networks.* In Pachter, L. and Sturmfels, B. Algebraic statistics for computational biology. Cambridge University Press. 322-334.

Bull, R., Epsy, K., & Wiebe, S.(2008). Short – term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at 7 years. *Developmental Neuropsychology, 33*, 205- 208.

Butler, D. L., Beckingham, B., & Lauscher, H. J. N. (2005). Promoting strategic learning by eighth grade students struggling in mathematics: A report of three case studies. *Learning Disabilities Research and Practice, 20,* 156-174.

Cawley, J., Foley, T. E., & Miller, J. (2003). Science and students with mild disabilities: Principle of universal design. *Intervention in School and Clinic, 38*(3), 160-171.

Clements, D., & Battista, M.(1990). The effects of logo on children's conceptualizations of angle and polygons. *Journal of Research Mathematics Education, 21*(5),356-371.

Cohen,J.(1988).*Statistical power analysis for the behavioral sciences*.Hillsdale- New Jersey: Lawrence Erlabaum Associates, Publisher.

Crutch, S., & Warrington, E. (2001). Acalculia: Deficits of operational and quantity number knowledge. *Journal of the International Neuropsychological Society,7*, 825-834.

Davison, C. G., & Neale, J. M. (1998). *Abnormal psychology (7th ed).* New-York. John Wiley & Sons, INC.

Deshler, D., Ellis, E., & Lenz, K. (1996). Teaching adolescents with learning disabilities: Strategies and methods. (2nd ed.). Denver, CO: Love.

DeSimone, J. R., & Parmar, R. S. (2006). Middle school mathematics teachers' beliefs about inclusion of students with learning disabilities. *Learning Disabilities Research & Practice, 21*(2), 98-110.

deVriess, S., Grift, W. J., & Jansen, E. P. (2014). How teachers beliefs about learning and teaching relate to their continuing professional development. *Teachers and Teaching: Theory and Practice,20*(3),338-357.

Dowker, A. (2004). What works for children with mathematical difficulties? Research Report, No 554. Nottingham: Department for Education and Skills.

Fennema, E., Carpenter, T., & Loef, M. (1990). *Mathematics beliefs scales*.Madison,

WI: University of Wisconsin, Madison.

Florian, L., & Rouse, M. (2009). The inclusive practice project in Scotland: teacher education for inclusion. *Teaching and Teacher Education, 25*(4), 594-601.

Forlin, C. (2004). Promoting inclusivity in Western Australian schools. *International Journal of Inclusive Education, 8*(2), 185-202.

Furner, J. M., Yahya, N., & Duffy, M. L. (2005). Teach mathematics: Strategies to reach all students. *Intervention in School and Clinic, 41*(1), 16-23.

Geary, D. C. (2004). Mathematics and learning disabilities. *Journal of Learning Disabilities, 37*, 4-15.

Geary, D. C. (1993). Mathematical disabilities: Cognitive, neuropsychological and genetic components. *Psychological Bulletin, 114*, 345-362.

Geary, C., Hamson, O., & Hoard, K. (2002). Numerical and arithmetical cognition: A longitudinal study of process and concept deficits in children with learning disabilities. *Journal of Experimental Child Psychology, 77*, 236-263.

Gersten, R., Clarke, B., & Mazzocco, M. (2007). Chapter 1: Historical and Contemporary perspectives on mathematical learning disabilities, In D.B.

Gonzalez, J. E., & Espinel, A. I. (2002). Strategy choice in solving arithmetic word problems: Are there differences between students with learning disabilities, G-V poor performance, and typical achievement students? *Learning Disabilities Quarterly, 25*, 113-122.

Hanich, L., & Jordan, N. (2001). Performance across different areas of mathematical cognition in children with learning disabilities. *Journal of Educational Psychology,* **93**, 615-626.

Hawkridge, D., **&** Vincent, T. (1992). *Learning difficulties and computers*. London: Jessica Kingsley Publishers.

Imbo, I., & Vandierrendonck, A. (2007). The role of the phonological loop and the central executive in simple-arithmetic strategies. *European Journal of Cognitive Psychology, 19*, 910-933.

Jordan, N. C. (2010). Early predictors of mathematics achievement and mathematics learning difficulties. Encyclopedia on Early Childhood Development, Centre of Excellence for Early Childhood Development Jordan NC. Retrieved from: http://udel.edu/~njordan/ Jordan_Encyclopedia%20on%20Early%20Childhood%20Development2010.pdf.

Jordan, N. C., & Hanich, L. B. (2000). Mathematical thinking in second-grade children with different forms of LD. *Journal of Learning Disabilities, 33*, 567-578.

Jitendra, A. K. (2002). Teaching students math problem-solving through graphic representations. *Teaching Exceptional Children, 34*(4), 34-38.

Jitendra, A. K., Griffin, C. C, Deatline-Buchman, A., & Sczesniak, E. (2007). Mathematical word problem solving in third-grade classrooms. *The Journal of Educational Research, 100*, 283-302.

Jones, W. G. (2001). Applying psychology to the teaching of basic math: A case study. *Inquiry, 6*(2), 60-65.

Kochhar, C. A.,West, L. L., & Taymans, J. M. (2000). *Successful inclusion: Practical strategies for a shared responsibility*. Upper Saddle River, NJ: Prentice Hall.

Krawec, J. L. (2010). *Problem representation and mathematical problem solving of students of varying math ability*. (Unpublished doctoral dissertation). University of Miami, Miami, FL.

Kroesbergen, E. H., & Van Luit, J. E. H. (2003). Mathematics interventions for children with special educational needs: A meta-analysis. *Remedial & Special Education, 24*, 97-**114** .

Kuyini, A. B., & Desai, I. (2007). Principals' and teachers' attitudes and knowledge of inclusive education as predictors of effective teaching practices in Ghana. *Journal of Research in Special Educational Needs, 7*(2), 104-113.

Leder, G., & Grootenboer, P. (2005). Affect and mathematics education. *Mathematics Education Research Journal, 17*(2), 1-8.

Levin, T., & Wadmany, R. (2006). Teachers' beliefs and practice in technology-based classrooms: A developmental view. *Journal of Research on Technology in Education, 39*(2), 157-181.

Maree, K. 1992*. Become an ace at maths*. Pretoria: Van Schaik.

McLeskey, J.,Waldron,N. L., So, T. H., Swanson, K.,&Loveland, T. (2001). Perspectives of teachers toward inclusive school programs. *Teacher Education and Special Education, 24,* 108–115.

Meese, R. L. (2001). Teaching learners with mild disabilities: Integrating research and practice. Belmont CA: Books/ Cole Publishing Co.

Moniuszko, L. K. (1991). Reality math. *Arithmetic Teacher, 39*(1),10-16.

Montis, K. K. (2000). Language development and concept flexibility in dyscalculia: A case study. *Journal for Research in Mathematics Education, 31*(5), 541-556.

Morgan, P. L., Farkas, G., & Wu, Q. (2009). Five-year growth trajectories of kindergarten children with learning difficulties in mathematics. *Journal of Learning Disabilities, 42*, 306-321.

National Council of Teachers of Mathematics (2000). Principles and standards for school of mathematics. Reston, VA.

Ostad, S.A. (1998). Developmental differences in solving simple arihmetic word problems and simple number fact problems: a comparison of mathematically normal and matemathically disabled children. *Mathematical Cognition, 4*(1), 1-19.

Paterson, D. (2007). Teachers' in-flight thinking in inclusive classrooms. *Journal of Learning Disabilities, 40*(5), 427-435.

Raymond, A.(1993). Unraveling the relationship between beginning elementary Teacher teachers' mathematics beliefs and teaching practice. ED 390694.

Rouse, M. (2008). Developing inclusive practice: A role for teachers and teacher education? *Education in the North, 16*(1), 6-13.

Sahin, C., Bullock, K., & Stables, A. (2002). Teachers' beliefs and practice in relation to their beliefs about questioning at key stage 2. *Educational Studies, 28*(4), 371-384.

Shahvarani, A., & Savizi, B. (2007). Analyzing some Iranian-high school teachers' beliefs on mathematics, mathematics learning and mathematics teaching. *Journal of Environmental & science Education, 2*(2), 54-59.

Shalev, R. S., Manor, O., Kerem, B., Ayali, M., Badichi, N., Friedlander, Y., & Gross- Tsur, V. (2001). Developmental dyscalculia is a familial learning disability. *Journal of Learning Disabilities, 34*, 59-65.

Sideridis,G.,D.,Antoniou, Faye & Padeliadu,Susana (2008). Teacher biases in the identification of learning disabilities: an application of the logistic multilevel model. *Learning Disability Quartrrly, 31*(4),199-209.

Smith, D. D. (2009). Introduction to special education: Making a difference (7th ed.). Boston, MA: Allyn & Bacon.

Stanberry, K., & Swanson, L. (2009). Effective reading interventions for kids with learning disabilities, LD Online, National Joint Committee on Learning Disabilities. Retrieved from: http://www.azpromisingpractices.com/teachers_reading.html.

Steedly, K., Dragoo, K., Arefeh, S., & Luke, S. (2008). Effective mathematics instruction. *Evidence for Education,3*(1),13-23.

Stigler, J. W. & Hiebert, J. (2004). Improving mathematics teaching. *Educational Leadership, 61*(5), 12-17. Retrieved from: http://sfx.hul.harvard.edu/citation/sfx_local

Sullivan, M., & Lewis, M. (2000). Assistive technology for the very young: Creating responsive environments. *Infants and Young Children, 12*(4), 34-52.

Sullivan, M., & Lewis, M. (1990). Contingency intervention: A program portrait. *Journal of Early Intervention 14*(4), 367-375.

Swanson, H. L., & Jerman, O. (2009). Math disabilities and reading disabilities. *Journal of Psycho Educational Assessment, 27*(3) 175-196.

Swanson, H. L., & Jerman, O. (2007). The influence of working memory on reading growth in subgroups of children with reading disabilities. *Journal of Experimental Child Psychology, 96*, 249-283.

Thanheiser,Eva, Browning, Christine, Edson, Alden. J., Kastberg, Signe& Lo, Jane- Jane(2013). Building a Knowledge Base: Understanding Prospective Elementary Teachers'

Mathematical Content Knowledge, *International Journal for Mathematics Teaching and Learning.* Retrieved from http://www.cimt.plymouth.ac.uk/journal/thanheiser.pdfThompson, T. (2005). Preparing teachers to teach mathematics to students with learning disabilities, the Mathematics Education into the 21st Century Project, University Technology Malaysia Reform, Revolution and Paradigm Shifts in Mathematics Education, Johor Bahru, Malaysia, Nov 25th – Dec 1st 2005**.**

Torbeyns, J., Verschaffel, L., & Ghesquiere, P. (2004). Strategy development in children with mathematical disabilities: Insights from choice/no choice method and chronological- age/ability-level-match design. *Journal of Learning Disabilities, 37*(1), 119-131.

Turnuklu, E., & Yesildere, S. (2007). The pedagogical knowledge in mathematics: Preserve primary mathematics teachers' perspectives in Turkey. *IUMPST, 1*, 1-13. Retrieved from: www.k-12prep.math.ttu.edu

Wagner, S., Lee, H., & Ozgun-Koca, A. (1999). A comparative study of the United States, Turkey, and Korea: Attitudes and beliefs of preserve mathematics teachers toward mathematics, teaching mathematics, and their teacher preparation program. ERIC, ED445907.

Wilson, M. S., & Cooney, T. J. (2002). Mathematics teacher change and development. In G. C. Leder, E. Pehkonen & G. Torner (Eds.), *Beliefs: A hidden variable in mathematics education* (pp. 127-147). Dordrecht: Kluwer.

Woodward, J., & Montague, M. (2002). Meeting the challenge of mathematics reform for students with learning disabilities. *Journal of Special Education, 36*(2), 89-101.

Yates , S.(2007). Primary teachers' mathematics beliefs, teaching practice and curriculum reform experience. From: www.aare.edu.au/06pap/yat06450.

Maintenance of Effective Hygiene and Sanitation in Barracks: The Roles of Warrant Officers in Ensuring Combat Ready Troops

T. B. Hammed

Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.

M.K.C Sridhar

Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.
Correspondence: T. B. Hammed Telephone: +234-08054718224
E-mail: hammetab2003@yahoo.co.uk

Abstract

A warrant officer (WO) is an officer in a military organization who is designated by a warrant, as distinguished from a commissioned officer and a non-commissioned officer who are designated by a commission and virtue of seniority respectively. This paper focuses on the results of a rapid appraisal exercise on the state of hygiene and sanitation at Adekunle Fajuyi Cantonment, Ojoo, Ibadan, so as to be able to expanding the roles of the WO in this very critical area to ensure combat ready troops in the barracks. Personal interview, medical record review, extensive literature search and observation checklist, scored on three point scale: highly present (70%) moderately present (20%) and present (10%), were used to collect data on the existing state of hygiene and sanitation, as well as their effects on health of the people in the barracks. Throughout the study, there was no noise or smoke as the atmosphere was peaceful and serene. Electricity was relatively stable. The source of drinking water was bore holes without further treatment. The waste was collected by the Ministry of Environment and Habitat, Oyo state and people carried out open dumping and burial methods for organic waste. There was no special schedule for both food and personal hygiene in the barracks. In the hospital, the beds were not enough with specific reference to children wards. Common diseases included traffic accident and malaria. The cause of malaria and accident could be linked to residents' poor attitudes of not using insecticide treated mosquito nets and complying with road safety and other sanitation regulations. The perceived problems of poor sanitation and hygiene practices were strongly related peoples' attitudes. The vast exposure of the warrant officers to other officers from different socio-cultural background should therefore be used to complement the efforts of environmental health officers in waiving war against culture of filth in the barracks.

Keywords- Personal hygiene, Warrant officer, Environmental health officers, Resident attitude, Military organisation

Introduction

Warrant Officers (WOs) are innovative integrators of emerging technologies, dynamic teachers, confident warfighters, and developers of specialized teams of soldiers. They support a wide range of Army missions throughout their career (Guzy and Michael, 2005). They refine their technical expertise and develop their leadership and management skills through tiered progressive assignment and education. The warrant officer corps began in the 13th century in the nascent English Royal Navy (Welsh et al. 2006). Recently, two major events occurred within the WO Corps that have changed their perceived roles. These events were the commissioning of WOs into the various branches of Army and the significant rise in numbers of professional WOs. There is therefore great need for defying new roles for the WOs that will cover, more especially, critical areas like maintaining and sustaining good sanitation and hygiene in the barracks.

According to the National Water Resources Management Policy (NWRMP) 2003, sanitation refers to the principles and practices relating to the collection, removal or disposal of human excreta, household waste water and refuse as they impact upon people and the environment. Good sanitation includes appropriate health and hygiene awareness and behaviour, and acceptable, affordable and sustainable sanitation services. The minimum acceptable basic level of sanitation must satisfy the following: be associated with appropriate health and hygiene awareness and behaviour; include a system for disposing of human excreta; household waste water and refuse, in a manner that is acceptable and affordable to the users; be safe, hygienic and easily accessible and which does not have an unacceptable impact on the environment; and provides a toilet facility for each household.

Military sanitation, like hygiene, is the Army way of keeping soldiers healthy, and preventing the spread of disease. Its primary aim is to keep as many men as possible in fighting trim, physically and mentally. In many wars, disease knocked out more soldiers than battle casualties. The danger of disease is always around the corner, and only constant attention to preventive medicine and sanitation can give protection against it. The basic principles of sanitation are the same in military as in civilian life. However, in the Army, soldiers are more exposed to different harsh environment and subjected to greater physical strain and more changes in surroundings; in climate, and in living habits than in civilian life.

Just like poverty is strongly associated with mental ill-health (Patel and Kleinman, 2003: Flisher et al. 2007; Lund et al. 2007), poor hygiene and sanitation can also affect people well-being and can be explained in terms of the vicious cycle of poor sanitation and mental ill-health. As the mental well-being of individuals is eroded by poor sanitation, the available energies within communities to contribute to nation-building are reduced. This paper therefore focuses on the results of a rapid appraisal exercise that was carried to assess the state of hygiene and sanitation at Adekunle Fajuyi Cantonment, Ojoo, Ibadan, so as to be able to suggest the roles a WO can play in this direction to ensure combat ready troops in the barracks.

Methodology

Description of the Study Area

With a total land area of 923,768km2, an estimated population of 144.7 million people (2.7% population growth rate) and illiteracy rate of 28% in 2008, Nigeria is the most populous in Africa, second largest economy in Sub-Saharan Africa after South Africa and the tenth largest producer of crude oil in the world at 2.1 million barrels per day. Most notably, health and hygiene has been attributed to poor water supply and sanitation situation. In 2007, maternal mortality rate was estimated to be 800 per 100,000 live births (UNDP) and was rated as one of the highest in the world (Uzochukwu Amakom, 2003). Ibadan is the capital city of Oyo State and the third largest metropolitan area in Nigeria by population after Lagos and Kano according to the 2006 Nigerian census. It has coordinates of 7°23′47″N 3°55′0″E and a total area of 1,189.2 sqm (3,080 km2).

Ibadan has a tropical wet and dry climate, with a lengthy wet season and relatively constant temperatures throughout the course of the year. Ibadan's, wet season runs from March through October, though August sees somewhat of a lull in precipitation (Areola, 1994). Adekunle Fajuyi Cantonment is located at Ojoo area of Ibadan and along Oyo township road. It covers about 100 heaters of land. The occupants comprised both military and civilian alike, in he ratio 80:20. There are 10 apartments in a block and over 2,000 servicing blocks in the barracks, not counting the dilapidated ones.

Data Collection Procedure

Personal interview, medical record review in the barrack hospital and direct observation were used to collect data on the existing state of hygiene and sanitation, as well as their effects on health of the population in the barracks. The observation checklist was scored on three point scale: highly present (70%) moderately present (20%) and present (10%).

Results and Discussion

Physical Structure and Infrastructure

The physical structures and infrastructure in the cantonment includes: offices, health care facilities, recreational facilities, bore holes, wells, good road network with drainages, corpers' lodge, bank, senior and junior staff quarters, farms, schools, mosque, church and others Throughout the study, conducted between 8am and 6pm for a week, there was no noise or smoke in the atmosphere. Electricity was relatively stable and people did not depend on generators (Table 1). The situation in the Adekunle Fajuyi Cantonment was far better in terms of sanitation and hygiene than many barracks in Lagos reported in The Punch (Ademola, 2013) which included Ijeh Police Barracks in Obalende, Alausa police barracks in Ikeja and Bonny Camp Army Barracks, among others.

The reason for clean and perceived sanitary condition could be traced to well-maintained discipline in the Cantonment. In an instance, the barracks Commander, Lt. Col Henry Mubakwe was reported to have issued an order at the 149 battalion's club where he met with all the block leaders in the barracks. He spoke with them for over three hours on the issue of cleanliness. At the end of the meeting the commander introduced the mandatory payment of levies on the first week of every month. The sum of N400 was to be paid by each apartment to the block leaders who would in turn bring the total sum collected to Mubakwe's office. The troops became dissatisfied. Mubakwe was said to have eventually silenced the protests by threatening everyone with charge of mutiny, citing the example of the 27 soldiers who were charged with the same offence for protesting nonpayment of their allowances in Akure (Comfort, 2013). Though there were ongoing business activities, the environment was calm and serene. There was heavy presence of flowers and trees especially beside the roads and in front of office quarters.

Table 1. Onsite observation for physical factors and basic amenities

S/N	INDICATOR	RANK
Environmental/Physical Factors		
1	Well-constructed drainages	++
2	Land degradation	-
3	Enough distance from place of religion	+++
4	Building for the workers	+++
5	Tarred road/ good road network	+++
6	Sloppy terrain	+
7	Bushy area	++
8	Rearing of pet/goat	++
9	Traffic jam	-
10	Presence of gully/other erosion	-
11	Presence of odour/smell	-
12	Vegetation- flower, grass and tree	+++
13	Presence of flies	-
14	Land use activities in the Cantonment	
	Shops,	++
	Farming,	+++
	Block making/other industries	-
	Religious activities	++
	Banking	++
Basic Amenities/Infrastructure		
15	Drinking water	++
16	Electricity	+++
17	offices	+++
18	Staff quarters	+++
19	Staff school	++
20	Recreational facilities	++
21	Medical facility	+

Key: +++ highly present   ++ moderately present   + present   - absent

Water Supply

Water and sanitation are among the most important determinants of public health. Wherever people achieve reliable access to safe drinking-water and adequate sanitation they have won a major battle against a wide range of diseases," says WHO Director-General, Dr. L.E.E. Jong-wook. The main sources of water in the barracks are boreholes and well (Fig. 1 and 2). According to the National Policy on Water and Sanitation (2000), access to water is defined as the percentage of the population that uses drinking water from improved sources while access to sanitation refers to the percentage of the population that uses improved sanitation facilities. Improved drinking water in Nigeria includes households' connections, public stand pipes, boreholes, protected wells and springs. A total of 6 boreholes were sunk across the barracks and people sourced water from these bore holes for drinking purpose. The well water was being used for other domestic activities. There was no water treatment facility or plant and water was consumed directly as it was taken from the boreholes. However, the quality of the water was being monitored by the Federal Ministry of Water Resources. The staff of this Ministry came every three months for water sampling and analysis. Although the results were reportedly fell within the guideline limits for drinking water, it was not clear whether the

copy of the results were made available to the barracks and the corresponding office could not be determined during the course of this exercise.

| Fig. 1. A well at junior staff quarters | Fig. 2. A borehole with storage tanks at office quarters |

Toilet Facility

At all buildings in the barracks – offices, quarters and market, water closet system toilets were being used. Once a toilet is full, mechanical emptying vehicle is solicited from Nigerian Prisons office in Ibadan to evacuate it. It was reported that a toilet in the mammy market was not was not adequate. A UNICEF-sponsored study in 2003 showed that, on average, there was only one toilet for every 500 students in elementary schools in Nigeria, ten times an acceptable standard of 50. Recent MDG monitoring figures from the WHO/UNICEF JMP suggested that, assuming an average of ten people per household, 7.75 million toilets needs to be built by 2015 in order to meet the Nigeria MDG sanitation target of 70% coverage by 2015. However, in practice more that this number of household latrines will need to be constructed because of the inevitable collapse, breakdown and abandonment of some low-cost latrines during the period 2008-2015 (Uzochukwu Amakom, 2003).

Refuse Disposal

The major components of solid include fallen leaves, PET bottle, paper, plastics and nylon (Fig. 3). In terms of solid waste management, the waste was regularly collected by the Ministry of Environment and Habitat, Oyo state through a registered private waste collector assigned to the barracks. At the staff quarters, people carry out burial method for organic waste and separate recyclable materials and sell to waste merchants that come from outside the barracks. In addition, other inorganic wastes that could not be sold to recyclers are burnt in open dump in the vicinity not too far away from the quarters. Fig. 4 shows different methods waste management practices in the barracks. The cantonment has an incinerator for burning of paper waste. It was located within office premises. Medium sized drums were also placed beside the road at a few meters to one another. On the dump sites goats were found roaming freely in search of food.
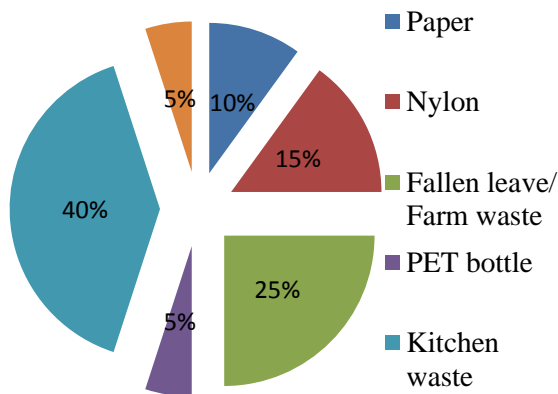
Paper
Nylon
Fallen leave/
Farm waste
PET bottle
Kitchen
waste

Waste collector
Burial method
Open dumping
Material
recovery
Incinerator

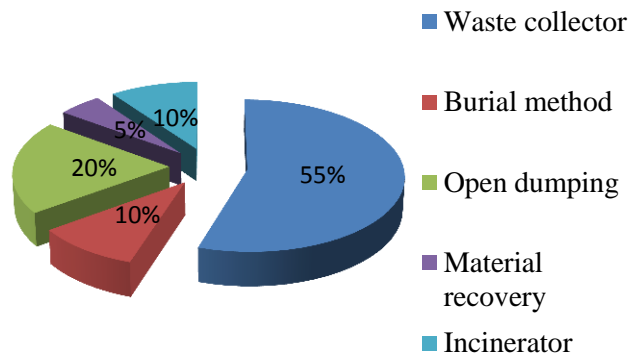**Fig. 3. Quantity of waste generated in the barracks**

Fig. 4. Waste management methods

Food premises and Personal Hygiene

There is no a special schedule or regulation for both food and personal hygiene in the barracks. However, there was Environmental Health Department that was responsible for monitoring the food vendors. In the market, vendors that violate sanitation rules would be sanctioned by the health officers who locked up their shops. The unit performs similar functions as there civil counterpart in the communities. No part of the soldier's everyday life is more important than a good food. Clean food is absolutely necessary for the Army's health. Contaminated or infected food is the main cause of intestinal diseases. Therefore food hygiene calls for constant vigilance over the food supply, in cleanliness, in cooking, and in refrigeration. It should also include supervision of food handlers, kitchen cleanliness and care of equipment. In the barracks, there is a big cooling facility for frozen foods and food preservation for general use.

An unclean body invites entry of germs. Therefore the entire body should be bathed not less than twice a week (daily in garrison). When facilities for a complete bath are not available, the body should at least be wiped with a clean, wet, soapy cloth, paying particular attention to the face, hands, armpits, crotch, and feet. Hands should always be washed after going to the toilet and also before eating. Underwear and shirts should be changed and washed at least twice a week.

Health care facility

In order to ascertain the effect of sanitation and hygiene on the officers in the barracks, their health records were reviewed and a senior nurse was interviewed. The hospital had standby ambulances and other vehicles in case of patient referral. There were 57 beds, a Doctor, 4 nurses mid wives, and about 6 auxiliary nurses as at time of investigation. According to the senior nurse interviewed, the beds were not enough with specific reference to children wards. There were no cases of water borne, typhoid and faeco-oral diseases, indicating effective sanitation in the cantonment. Common diseases normally attended to include traffic accidents, appendicitis and malaria. The cause of malaria could not be ascertained since the premises were reported to be regularly fumigated monthly and residents were given insecticide treated mosquito nets. However, from direct observation, there was a lot of bush in the other side of the major road that had not been developed. This might probably resulted into the breeding of mosquitoes that cause malaria.

The military barrack involves a unique living arrangement with a large number of military recruits living in close physical proximity. The close proximity of the individuals can lead to rapid transmission of certain infections in this setting. Early studies among military recruits showed that incidence of respiratory disease increased with an increase in the number of recruits in training

(Miller, 1963). Other studies demonstrated increased rates of respiratory infections during the winter months (Sartwell, 1951). Outbreaks of pneumococcal pneumonia among recruits have also been reported (Pazzaglia, 1983). In view of the high burden of a potential epidemic in the barracks, the military actively vaccinates all recruits in barracks to minimize the spread of vaccine-preventable infections (Vivek Kak, 2007). The widespread use of these vaccines by the military has been successful in preventing the epidemics that occurred in the past. Vaccination was a routine practice in the Adekunle Fajuyi Cantonment, the study area. This had great impact on the residents as witnessed from medical records.

Housing Facilities

There were two categories of house in the barracks, depending on the levels of officers. Separate apartments of three or four bedroom were but for the high ranking officers while story building with several two bed rooms flats were built for the junior staff. In either case, water and other basic amenities were provided. No open dumping was found at the senior staff apartments unlike their junior counterpart. Also there was adequate ventilation and availability of toilets, drains, and the windows were screened.

Other Sanitation and Hygiene Activities

Many precautionary measures were being taken to reduce occupational health hazards and road accidents in the barracks. Among these is the enforcement of helmet on motorcycle riders, continuing health education, immunisation and inoculation, and distribution of free insecticide treated mosquito net. Although, most of the residents did not use mosquito nets, sun flies was another major problem being encountered by some of them that used it; the flies could not be prevented by mosquito net. Many of the residents get suffer from skin rashes and other infection as a result of sun fly bite.

Defining New Roles for WOs – their Expectation in Maintaining Sanitation and Hygiene in the Barracks

As it has been the case, the Medical Department is charged with the responsibility of investigating sanitary conditions in the Army, and of making recommendations about camp locations, water supply and purification, methods of waste disposal, prevention of disease, and all means of effecting immunity among military personnel. Meanwhile, WOs are the middle officers that are normally delegated to carry out various military duties assigned to them. They are normally found in all departments. The followings are how the WOs carry out their responsibilities:

As Trainers- Instruct technical subjects at the entry level and applies automated system skills to classroom instruction.

As Operators- Applie basic skills to operate systems and perform activities in support of organizational missions.

As Maintainers- Supervise maintenance personnel to keep equipment and systems in a state of operational readiness.

As Administrators- Apply basic understanding of personnel, logistics, information management, organizational operations, training support, and budget management.

As Managers- Apply basic understanding of regulations and policies governing the Army.

As Integrators- Coordinate basic functions and interoperability of Army systems at the unit level.

As Advisors- Provide technical and tactical advice in their related fields of expertise to the immediate command structure.

As Leaders- Influence others by providing purpose, direction, team building, and motivation.

As Mentors- Expand on professional development through increased responsibilities and develops basic mentoring and counseling skills.

In order to maintain combat ready troops in the barracks, the responsibility of sustaining good sanitation and hygienic health should be shifted from the Chief Medical Director to complement the duties of WOs would typically involve in g: inspecting businesses for health and safety, food hygiene and food standards, following up complaints and investigating outbreaks of food poisoning, infectious disease or pests, collecting samples for laboratory testing, enforcing environmental health laws, investigating health and safety at work, advising the community and giving educational talks, giving evidence in cases that come to court, and keeping records and writing reports. These tasks can be easily performed as the number and level of qualification of WOs recruited into Army increases.

Conclusion

It has been established that the Adekunle Fajuyi Cantonment maintained good sanitation and hygiene. Common diseases included traffic accident and malaria. The cause of malaria and accident could be linked to residents' poor attitudes of not using insecticide treated mosquito nets and complying with road safety and other sanitation regulations. Unfortunately, the environmental health officers and Medical Director that are saddled with up- keeping hygiene and sanitation in the barracks have little socio-cultural relationship with other military staff. Due to the dominance of warrant officers among all the stake holders in the barracks and their various experiences across all Departments, their roles are expected to include maintenance of hygiene and sanitation practices at all times to break the vicious cycle of ill health and poor environment to ensure combat ready troops.

Recommendations

Based on the findings of this study, the following recommendations are hereby proffered:

- The bush in the undeveloped area in the barracks should be cleared to avoid mosquito breeding

- Report of water analysis should be made available to the cantonment

- Hand washing should be encouraged after using the toilet by providing water and soap in front of each toilet.

- All open dumps should be prohibited in the barracks to avoid outbreak of diseases

- There is need for proper on-site waste management facilities rather than depending on the outside agencies.

- Warrant Officers and Environmental Health Officers need more training on waste recycling for converting organic waste into fertilizer instead of dumping or burying.

References

Ademola O. (2013). No easy life in the barracks. The Punch January 19, 2013: 24.

Areola, O. (1994). The spatial growth of Ibadan city and its implication on rural hinterland in Ibadan region. Ibadan: RexCharles and Cann Publication. 98-106.

Comfort O. (2013). Soldiers oppose sanitation levy at Ojo Military Cantonment. Issue of The Punch. February 27, 2013: 55.

Development and Implementation in four African countries. *Journal of Health Psychology*, 12, 505–516.

Flisher, A..J., Lund, C., Funk, M., Banda, M., Bhana, A., Doku, V. et al. (2007). *Mental health policy*. pp. 1-50.

Guzy and Michael (2005). Defining the role of the Warrant Officer. *Military Intelligence Professional Bulletin*. pp 1-10.

Lund, C., Breen, A., Flisher, A. J., Swartz, L., Joska, J., Corrigall, J et al. (2007a). Mental health And poverty: a systematic review of the research in low and middle income countries. *The Journal of Mental Health Policy and Economics*, 10, Supplement 1, S26–S27. Mil Med;148(8):647–51.

Mille,r L.F.R., Pierce W E., Rosenbaum M. J. (1963) Epidemiology of non-bacterial pneumonia among naval recruits. *JAMA*, 185(2):128–35.

National Water Policy (2004). Federal Republic of Nigeria. pp1-48.

Patel, V. and Kleinman, A. (2003). Poverty and common mental disorders in developing countries. *Bulletin of The World Health Organization,* 81(8):609–1.

Pazzaglia G., Pasternal M. (1983). Recent trends of pneumonia morbidity in US naval personnel.

Sartwell P E (1951). Common respiratory disease in recruits. *Am J Hyg*, 53(2):224–35.

Uzochukwu A. (2003). Sanitation Sector Status and Gap Analysis: Nigeria. Global Sanitation Fund Water Supply & Sanitation Collaborative Council Manual. 1-48.

Vivek Kak, M.D. (2007). Infections in Confined Spaces: Cruise Ships, Military Barracks, and College Dormitories. *Infect Dis Clin N Am*. 21: 773–784.

Welsh, D.R.W. (2006). The Legacy of Leadership as a Warrant Officer. Nashville, Tennessee: Turner Publishing Company, Retrieved 30 August 2013. ISBN 978-1-59652-053-0. p 6.

Effect of Soil Type and Depth of Sowing on the Seedling Emergence, Growth and Yield Performance of Chinese long bean

S. M. Rezaul Karim,

Professor, Faculty of Agro Based Industry,

Mohd Fazril bin Mohd Zayad

Graduate student, Faculty of Agro Based Industry,

Shafiqur Rahman

Senior Lecturer, Faculty of Earth Science, Universiti Malaysia Kelantan, Jeli Campus, 17600 Jeli, Kelantan, Malaysia

Department of Parasitology, Graduate School of Health Science, Kobe University, Kobe, Japan (shafiqurdhaka@gmail.com)

Corresponding author's E-mail: rezaul@umk.edu.my

Abstract

Planting depth and soil type are important growth conditions which affect the performance of different crops. This research was conducted to find out the effect of different planting depths (1 cm, 2 cm, 4 cm and 8 cm) under two different types of soil (loamy soil and sandy soil) on seedling emergence, plant growth and yield performance of Chinese long bean (*Vigna unguiculata*). The experiment was done following Randomized Complete Block Design with four replications per treatment. Data were collected on seedling emergence, plant height, number of branches per plant, number of leaves per plant, number of pods per plant, weight of pods per plant and seeds per pod. Loamy soil clearly gave the best result in respect of seedling emergence, growth and yield of long bean compared to sandy soil. Sowing depth affected mean seedling emergence, plant height, branches produced, number of leaves per plant, number of pods produced, weight of pods and seeds produced per pod. Sowing at 4 cm in loamy soil presented the best results in terms of long bean yield. Sowing beyond 4 cm gave the relatively lower seedling emergence, growth and yield performance of the Chinese long bean.

Keywords: Long bean, Sowing depth, Soil types

1. Introduction

Chinese long bean (*Vigna unguiculata*) or Kacang panjang (Local Malay name) is an important vegetable crop in Malaysia. In order to raise a good crop yield we must consider the proper planting depth and soil type for the crop (Aikins and Afuakwa, 2008).

Crop plants should be planted at the proper depth to achieve a uniform stand of the intended population. Optimum planting depth is generally related to the seed size and soil type. Large seeds can emerge from greater depths because they have larger stored food reserves that can be utilized for germination and emergence. Seed size, type of emergence, and the type of soil in which the seeds are planted determine the optimum depth of planting (Grundy *et al.,* 1996). The seed must be able to imbibe enough water to germinate before the soils surrounding it dries out. Appropriate planting depth ensures the seeds to be completely covered with soil that can take enough water in for germination to proceed (Benvenuti *et al.,* 2001).

Depth of planting is also influenced by soil type. Deeper plantings are possible in lighter soils than in heavy soils. The surface dries out quickly in sandy soils making deeper plantings necessary for placing the seed in moist soil. In cold, wet soils, shallower plantings are required because the oxygen concentration and temperature at greater depths may be too low for germination, especially in early spring (McNabb *et al.,* 2001).

All these information indicate that the crops including Chinese long bean must be sown at proper depth with appropriate type of soil, which can ensure good production. With these ends in view, the research was conducted to find out the impacts of sowing depths in two different soil types on seedling emergence, the plant growth and yield performance of Chinese long bean.

2. Materials and methods

The experiment was conducted in polybags under net house condition at the Agro Park at Jeli Campus, University Malaysia Kelantan (UMK) during the period from 12 March 2012 to 23 May 2012. Chinese long bean seeds were purchased from the local market. The germination percentage of the purchased seeds was determined in laboratory test and found as 90%. Two different types of soil e.g. loamy soil and sandy soil, were collected from Agro Park site at Jeli campus, UMK. Preliminary soil analysis indicated that loamy soil was belonged to clay loam containing 34.5% clay content which felt spongy and smooth with no obvious sandiness. On the other hand, sandy soil was characterized by sandy in touch containing only 11.0% clay content and it was belonged to sandy loan texture. The long bean seeds were sown at four different depths e.g. 1 cm, 2 cm, 4 cm and 8 cm using polybags filled with field soil mixed with compost at the ratio of 3:1. Altogether 16 polybags were filled with loamy soil and another 16 polybags were filled with sandy soil mixed with compost. Twenty long bean seeds were sown per polybag as per treatment specification on 24 March 2012. Watering was done every day as per necessity for plant establishment. The experiment was assigned in a Randomized Complete Block Design with four replications per treatment. After seedlings had emerged, the data on seed germination was recorded at seven days of sowing and all the seedlings were removed except one. After raising the long bean seedling in polybags, the polybags were arranged as per the layout. An amount of 200 g compost per polybag was added per two weeks as fertilizing material as per recommendation of Jabatan Pertanian Perak, Malaysia. After three weeks of sowing the long bean plants were mounted on 2 m high fence trellises. Harvesting was done after two months of sowing.

Data were collected at maturity (23 May 2012) on the following plant characters- plant height, number of branches per plant, number of leaves per plant, number of pods per plant, weight of pod per plant, number of seeds per pod. Collected data were subjected to statistical analysis using the statistical program SPSS and mean differences were adjudged using LSD.

3. Results and discussions

Effect of soil type

Results showed that although seedling emergence and some of the vegetative characters were not varied significantly but all the reproductive characters were influenced significantly (P < 0.05) due to soil types. The crop produced higher number of pods, heavier pods and higher number of seeds per pod in loamy soil (Table 1). It is obvious that, sandy soil provided with higher seedlings emergence but the differences was not significant. However, yield performance of pods of long bean in loamy soil was better than the yield performance of the crop in sandy soil.

Ossom and Rhykerd (2007) found that soil chemical properties influenced the plant growth and development, as well as the concentrations of various mineral nutrients within the plant. As fine textured soils (loamy soil) contain higher amounts of organic matter than coarse textured soil, sandy soils it might played a big role in affecting the long bean growth and yield (Mtambanengwe *et al*., 2004). Similarly, Micheni *et al*. (2004) stated that soil organic matter plays an important role in maintaining physical, chemical and biological properties of the soil, and consequently the crop productivity and yield are also enhanced. Similar effects were also noticed in case of number of branches produced and the number of leaves produced by the crop, where long bean plant on loamy soil had higher mean values in those plant characters.

Table 1. Effect of soil type on the seedling emergence, plant height, number of branches, number of leaves, number of pods, weight of pods and number of seeds/pod of long bean

Soil type	Seedlings emergence (no.)	Plant height (cm)	Number of branch/ plant	Number of leaf/ plant	Number of pod/ plant	Weight of pod/ plant (g)	Number of seed/pod
Loamy soil	8.61	123.31	13.44	31.86	6.04	27.43	7.40
Sandy soil	9.31	121.68	10.94	29.02	3.97	24.39	4.83
LSD (5%)	1.825	1.883	1.142	1.144	1.191	1.164	1.420
Mean	8.96	122.50	12.19	30.44	5.01	25.91	6.11

In compacted soils e.g. clay soil or clay loam, soil strength and limited aeration may affect seedling emergence (McNabb *et al.,* 2001). Sandy soil had lower compactness compared to loamy soil which may offer better aeration to the long bean seed germination. Bengough and Mullins (1996) and Jamieson *et al.* (1988) reported that dense soil may limit root growth by creating a large mechanical resistance to root growth and restricting the rate of oxygen supply to roots. However, plant growth after seedling emergence is mostly depending on the nutrient supply to the plants which is mostly favoured by clay loam soil (Table 1).

Effect of sowing depth

Table 2 shows the effect of sowing depth on the seedling emergence, plant height, number of branches, number of leaves, number of pods, weight of pods and number of seeds/pod of Chinese long bean. It is clear that all the plant characters were significantly influenced by the depth of sowing (P<0.05). It can be seen that the sowing depth of 2 cm had the best means in term of seedlings emergence, plant height, number of branches and the number of leaves per plant, identically followed by sowing depth of 4 cm. However the number of pod per plant, the weight of individual seed and the number of seeds per pod were higher under 4 cm sowing depth (Table 2). The worst performance of long bean, in all these plant characters, observed from the sowing depth of 8 cm where it had low seedlings emergence and plant development, and finally gave no yield at all (Table 2).

It can be mentioned here that with the increase of sowing depth the aeration was reduced and physical resistance from the soil was increased. It is assumed that the too deep sowing (example, 8

cm sowing depth) probably prevented the seedlings from pushing their shoots above through the thick soil layer making it slower to grow than other depths used in this experiment. McNabb *et al.,* (2001), Bengough and Mullins (1996), and Jamieson *et al.* (1988) reported that dense and deep soil may limit root growth by creating a large mechanical resistance to root growth and restricting the rate of oxygen supply to roots. This also supports the reason why 8 cm sowing depth had the lowest seedling emergence. Meanwhile planting long bean seed on the shallow depth (1 cm) resulted in low seedlings emergence as well. It may be due to inadequate soil moisture at the top soil layer. The surface land was quickly dried up due to the sun light and exposure to the air.

So planting comparatively in deeper layer ensures that seeds are completely covered with soil and took enough water in for germination to proceed (Benvenuti *et al.,* 2001). As 2 cm sowing depth showed early germination, it may give the opportunity for the long bean to establish faster and thus to produce higher plant development. Similar findings were also reportedly by Aikins and Afuakwa (2008), where too deep sowing prevented seedlings establishment.

Table 2. Effect of sowing depth on the seedling emergence, plant height, number of branches produced, number of leaves produced, number of pods produced, weight of pods and number of seeds/pod of long bean

Sowing depth	Seedling emergence (no.)	Plant height (cm)	Number of branch/ plant	Number of leaf/ plant	Number of pod/ plant	Weight of pod/ plant (g)	Number of seed/ pod
1.0 cm	3.75	92.00	9.50	28.50	1.63	5.75	3.82
2.0 cm	19.25	199.35	16.25	48.88	8.00	39.38	9.63
4.0 cm	15.15	186.00	15.38	47.13	10.38	58.50	11.00
8.0 cm	0.70	21.25	2.38	7.13	0.00	0.00	0.00
LSD (5%)	1.10	1.22	1.81	1.80	1.11	1.42	1.41
Mean	8.96	122.15	10.13	30.41	5.00	25.91	6.11

However, yield performance (number of pod/plant, weight of individual pod and number of seeds per pod) were higher under 4 cm sowing depth followed by 2 cm. It may be due to higher moisture content in 4 cm sowing depth. Deeper planting depth within a limit means deeper access to preserve moisture in soil. Grundy *et al.* (1996) said some plants need to be planted deeper than others for subsequent desirable growth.

Table 3. Interaction effect of soil type and sowing depth on the seedling emergence, plant height, number of branches, number of leaves, number of pods, weight of pods and number of seeds/pod of long bean

Soil type	Sowing depth (cm)	Seedlings emergence (no.)	Plant height (cm)	Number of branch/ plant	Number of leaf/ plant	Number of pod/ plant	Weight of pod/ plant (g)	Number of seed/ pod
Loamy soil	1.0 cm	3.65	94.00	10.00	29.50	2.20	6.25	4.35
	2.0 cm	18.65	200.75	20.75	49.46	9.25	40.45	11.75
	4.0 cm	11.55	178.00	20.25	41.25	12.71	63.00	13.50
	8.0 cm	0.60	20.50	2.76	7.26	0.00	0.00	0.00
	Mean	8.61	123.31	13.44	31.86	6.04	27.43	7.40
Sandy soil	1.0 cm	3.85	90.00	9.00	27.50	1.10	5.25	3.30
	2.0 cm	19.85	198.75	12.25	48.31	6.75	38.30	7.50
	4.0 cm	12.75	176.00	20.50	33.25	8.05	54.00	8.50
	8.0 cm	0.80	22.00	2.00	7.00	0.00	0.00	0.00
	Mean	9.31	121.68	10.94	29.02	3.97	24.39	4.83
	LSD(5%)	1.24	2.13	1.31	1.32	1.11	1.12	1.19

It is obvious that although 2 cm depth produced the slightly higher seedlings emergence under sandy soil, but it could not produce better plant development and higher pod yield. In case of sandy soil, under 2 cm soil depth although the seedling emergence, plant height and number of leaves per plant were slightly higher than 4 cm but number of branches, number of pods per plant and the weight of pods per plant were higher under 4 cm soil depth. On the other hand, under 4 cm soil depth in loamy soil, although seedling emergence was less than 2 cm depth most of the plant characters were better than 2 cm depth in the same type of soil and finally it lead to higher production of pods per plant and heavier seed per pod (Table 3).

5. Conclusion

It could be concluded that sowing at 4 cm in loamy soil is optimum for long bean under the conditions of the present investigation for good harvest. Sowing beyond 4 cm is not good for seedling emergence, growth, and pod yield. Loamy soil is clearly gave the best result for overall long bean seedling emergence, growth, and pod yield. It is to be mentioned that the overall growth of the vegetable was not good enough under this experimental conditions and the pod yield was lesser than other commercial crop cultivation. More studies should be conducted especially under field conditions or under controlled environmental conditions to make a recommendation.

6. Acknowledgement

7. References

Aikins, S. H. M. & Afuakwa, J. J. (2008). Growth and dry matter yield responses of cowpea to different sowing depths. *ARPN Journal of Agricultural and Biological Science* 3: 50-54.

Bengough, A. G. & Mullins, C. E. (1996). Mechanical impedance to root growth: a review of experimental techniques and root growth responses. *Journal of Soil Science,* 41, 341-358.

Benvenuti, S., Macchia, M. & Miele, S. (2001). Qualitative analysis of emergence of seedlings from buried weed seeds with increasing soil depth. *Weed Sci.*, 49: 528-535.

Grundy, A. E., Meand, A. R. & Sond, W. (1996). Modeling the effect of weed-seed distribution in the soil profile on seedling emergence. *Weed Research*, 36: 375-376.

Jamieson, J. E., Morris, R. J. & Mullins, C. E. (1988). Effect of subsoiling on physical properties and crop growth on a sandy soil with naturally compact subsoil. *Proceedings of the 1lth Conference of the International Soil Tillage Research Organisation,* 2: 499-503.

McNabb, D. H., Startsev, A. D. and Nguyen, H. (2001). Soil Wetness and Traffic Level Effects on Bulk Density and Air-Filled Porosity of Compacted Boreal Forest Soils. *Soil Science Society of America Journal.* 65: 1238-1247.

Micheni, A., Kihanda, F. and Irungu, J. (2004). Soil organic matter: the basis for improved crop production in arid and semi-arid climate of eastern Kenya. In: *Managing nutrient cycles to sustain soil fertility in sub-Saharan Africa*. p. 608.

Mtambanengwe, F., Mapfumo, P. & Kirchmann, H. (2004). Decomposition of organic matter in soil as influenced by texture and pore size distribution. In: *Managing nutrient cycles to sustain soil fertility in sub-Saharan Africa*. p. 608.

Ossom, E. M. & Rhykerd, R. L. (2007). Effects of Corn (*Zea mays* L.) and grain legume associations on soil mineral nutrient concentration, soil temperature, crop yield, land equivalent ratio and gross income in Swaziland. *Proceedings of the 8th Afr. Crop Sci. Conf.* 27-31 Oct. 2007, El-Minia, Egypt.

Screening of Weed-competitive Variety of Transplant Aman Rice, Its Optimum Nitrogen Dose and Plant Spacing for Effective Weed Management

S. M. Rezaul Kariz

Faculty of Agro Based Industry, Universiti Malaysia Kelantan, Jeli Campus, Malaysia,

Golam Mohammad Faruk

Subject Matter Specialist, Directorate of Agricultural Extension, Khamarbari, Farmgate, Dhaka 1205, Bangladesh,

M. A. Hakim

Department of Land Management, University Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
Corresponding author: rezaul@umk.edu.my

Abstract

Two experiments were conducted at the Bangladesh Agricultural University, Mymensingh to screen out the highly competitive variety of transplant aman rice and to find out its appropriate weed management practices. Twelve varieties namely BR22, BR23, BRRI dhan30, BRRIdhan31, BRRIdhan32, BRRIdhan34, BRRIdhan37, BRRIdhan38, BRRIdhan39, BRRIdhan40, Binasail and Binadhan-4 were grown in presence and in absence of the weed *Echinochloa crusgalli*. Monoculture of the weed was also maintained. The aggressivity of rice varieties was measured against the weed. The study was further expanded in finding out the best nitrogen dose and plant spacing for providing the selected variety with more competitiveness. Finally the yield performance of the selected rice under the selected management practices was assessed. Variety BRRI dhan30 was found to be the most competitive (aggressivity = 0.43) and Binadhan4 was the least competitive variety (aggressivity = 0.05). The nitrogen dose of 80 kg N ha^{-1} and plant spacing of 25 cm X 15 cm rendered the best competitiveness (aggressivity = 0.60) to the variety under the condition of experiments. The variety BRRI dhan30 also produced the highest grain yield (5.2 t ha^{-1}) and the lowest yield loss (21.99%) due to weed competition under the management practices.

Keywords: Aggressivity, Competitive ranking, Transplant aman rice, Nitrogen versus competitiveness, Spacing versus competitiveness

1. Introduction

Rice is the most essential cereal crop in Asia, where 92 per cent of the world rice is produced (Fairhurst and Dobermann, 2002). Transplant *Aman* rice (transplanted Autumn rice) has a longer life cycle than other rice types and it faces severe aggression by different weeds, of which barnyard grass (*Echinochloa crusgalli* L*)* is the most dominated one. Manual and mechanical weed controls are expensive methods especially during labour crisis period. Although chemical weed control is easy and economic compared with other weed control measures but indiscriminate use of the chemicals leaves residues in soil, water, air and food, which causes threat to public life, badly affects our environment and becomes harmful to the beneficial insects and microorganisms. Biological method is safe for environment, less expensive and sustainable if it is adopted properly. Use of weed-competitive variety of crop is one of the ways of biological control. The use of competitive crop varieties to suppress weed population is now thought to be an avenue for weed control along with adoption of different cultural control measures in rice. The scientists of International Rice Research Institute, Philippines noted that using weed competitive rice variety could provide practical equivalent of one to two additional hand weeding. Weed-suppressive rice varieties have been suggested as a tool that could improve weed control and reduce the reliance on herbicides (Gibson *et al.* 2003; Tironi *et al*. 2009; Christensen, 1995). Therefore, it is important to know the competitive ability of different varieties of rice against weeds and screening out of highly competitive Transplant *Aman* rice variety against barnyard grass (*E. crusgalli*) is of prime importance in order to combat the weed problem.

Nitrogen fertilizer is an inevitable nutrient for the growth of rice plant. Proper plant spacing of rice plays indirect but key role for absorption of necessary nutrients, well tillering, higher leaf area, etc. The competitive ability as well as yield of rice is influenced by a number of factors of which judicious application of nitrogen and justified plant spacing in the field are important (Vasquez *et al*. 2008; Blackshaw and O'Donovan, 1993). The maximum yield with minimum cost concept may be realized with the highest competitive rice against weed, which would be properly treated with appropriate fertilizer and planting density. With this end in view, these studies were conducted with the following objectives – i) to measure the competitive ability of Transplant *Aman* rice varieties against barnyard grass, and ii) to find out the optimum nitrogen level and plant density for increasing the competitiveness of the selected Transplant *Aman* rice variety (ies).

2. Materials and Methods

Two experiments were conducted in the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh to screen out the highly competitive Transplant *Aman* rice variety against barnyard grass (*E. crusgalli*). Then the effects of nitrogen fertilization and plant spacing on the performance of the selected competitive varieties in weed suppression and providing grain yield were studied to develop the technologies to increase its suppressive ability of particular rice variety. The yield performance of the selected Transplant *Aman* rice variety was also studied.

Experiment 1. **Screening of weed suppressive cultivars of Transplant *Aman* rice against barnyard grass.**

Twelve rice varieties namely BR22, BR23, BRRI dhan30, BRRIdhan31, BRRIdhan32, BRRIdhan34, BRRIdhan37, BRRIdhan38, BRRIdhan39, BRRIdhan40, Binasail and Binadhan-4 were grown in presence and in absence of the test weed, barnyard grass (*Echinochloa crusgalli* L.). Monoculture of rice varieties was also maintained. Rice seedlings of 35 days old were transplanted in the main field at the spacing of 25 cm×15 cm. Previously raised weed seedlings at 2 leaves-stage were transplanted in the rice-weed mixture plots maintaining a uniform distribution in the whole area of the unit plot at a density of 100 seedlings/m^{-2} (Chang, 1970). The same density of weed was maintained in the monoculture of weed. The experiment was laid out in a randomized complete block design with three replications. Five samples of rice and weed were also selected randomly

from the peripheral area of each unit plot and were sampled through destructive harvesting. The collected samples were dried in an electric oven at 80 ^{0}C for three days and dry weights of the samples were recorded. The competitive ability of the varieties was evaluated by calculating aggressivity values following the formula of McGilchrist and Trenbath (1971).

$$\text{Aggressivity (rice)} = (W_{ab}/W_{aa}) - (W_{ba}/W_{bb})$$

where, W_{ab} = weight per plant of rice mixed with weed, W_{aa} = per plant weight of rice in monoculture, i.e. rice without weed, W_{ba} = per plant weight of weed mixed with rice, W_{bb} = per plant weight of weed in monoculture.

Experiment 2. **Effect of different levels of nitrogen and spacing on the competitive ability of the selected variety of Transplant *Aman* rice (BRRI dhan30) against barnyard grass.**

Five levels of nitrogen in the form of urea e.g. i) 0 N kg/ha, ii) 60 kg N/ha, iii) 80 kg N/ha, iv) 100 kg N/ha and v) 120 kg N/ha; and three levels of plant spacing e.g. i) 20 cm × 10 cm (less than normal spacing), ii) 25 cm × 15 cm (normal spacing) and iii) 30 cm × 20 cm (more than normal spacing) were considered in the study. The optimum doses of nitrogen and spacing as per BRRI recommendation are 80 kg N ha^{-1} and 25 cm×15 cm, respectively (BRRI, 2004). The variety was grown in presence and in absence of barnyard grass as per specification of experiment 1. Monoculture of weed was maintained and the aggressivity was calculated following the formula as mentioned earlier.

Collected data were analysed statistically using statistical program MINITAB version 11 to do the ANOVA and the mean differences were adjudged using DMRT (Gomez and Gomez, 1984).

3. Results and Discussion

Aggressivity of rice varieties

Crop aggressivity was determined by subtracting the relative yields of weeds from that of rice. Therefore, the resultant effects of both the competition from rice on weed and that of weed on rice have been considered. Significant differences were observed among the varieties in their aggressiveness against barnyard grass at different days after transplanting and at harvest. Mean aggressivity values of all the varieties at different growth stages exhibited significant variation in both the years. Among the varieties of Transplant *Aman* rice, BRRI dhan30 (mean aggressivity = 0.43) was the most aggressive against the weed followed by BRRI dhan31 (mean aggressivity = 0.38) and the least aggressive variety was Binadhan-4 (mean aggressivity = 0.05) (Fig. 1). The variety BRRI dhan30 was 12.4% more aggressive than the variety BRRI dhan31. The competitive ability of BRRI dhan30 might be due to the higher leaf area index, the highest number of tillers plant^{-1} and the highest crop dry matter production (data have not shown). This result is similar to Balyan *et al.* (1991) who stated that plant characters like plant height, total number of tillers hill^{-1}, total dry matter etc. have positive effects on competitive ability. Similar findings were also reported by Karim (1999) in barley. In 2003, the competitive ranking of the rice varieties was BRRI dhan30 > BRRI dhan31> BR23 > BRRI dhan32 > BR22 > BRRI dhan40 > Binasail > BRRI dhan39 > BRRIdhan 34> BRRI dhan37> BRRI dhan38> Binadhan-4 (Fig. 1). This ranking of the varieties in respect of their aggressiveness was consistent in all the growth stages.

In general varieties that are more susceptible to weed competition are less desirable than tolerant or weed suppressive varieties because they would not only suffer greater yield reduction but also permit greater weed seed replenishment of the soil seed bank that could contribute to future weed infestations (Wilson *et al.* 1995; Wallinga and Van Oijen, 1997).
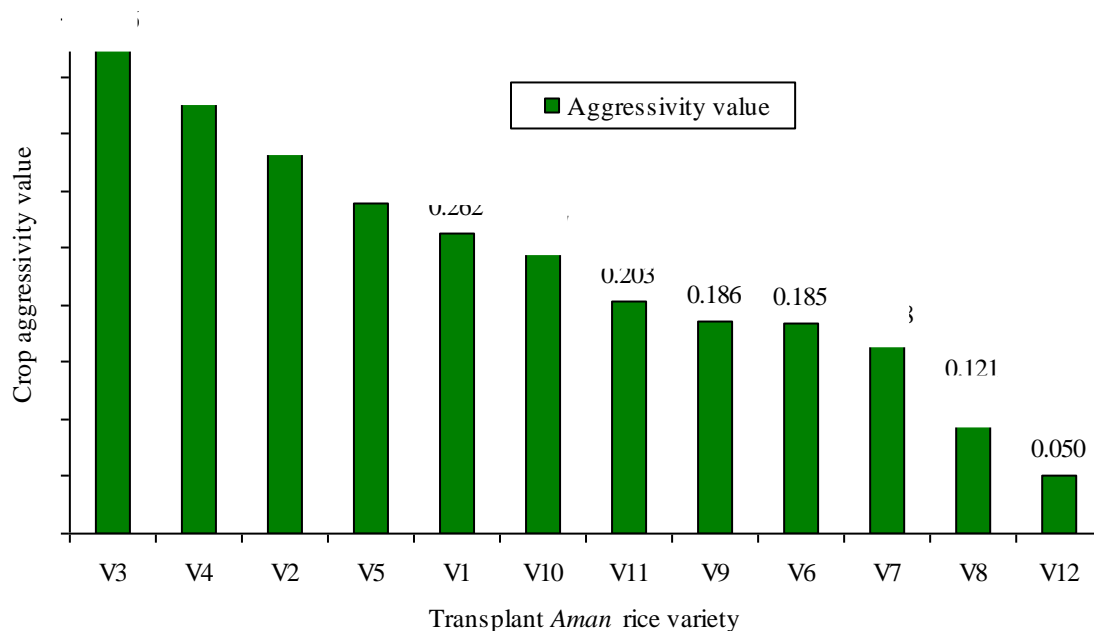
Fig. 1. Aggressivity ranking of Transplant *Aman* rice varieties against barnyard grass.

(V1=BR22, V2=BR23, V3=BRRI dhan30, V4=BRRI dhan31, V5=BRRI dhan32, V6=BRRI dhan34, V7=BRRI dhan37, V8=BRRI dhan38, V9=BRRI dhan39, V10=BRRI dhan40, V11=Binasail, V12=Binadhan-4. The bars having similar letter(s) do not differ significantly whereas figure having dissimilar letter(s) differ significantly as per DMRT).

Effect of nitrogen application and plant spacing

The aggressivity of rice variety was calculated only at two stages - at maximum tillering stage (60 DAT) and at harvest. BRRI dhan30 showed significant variation in aggressivity values at two growth stages and it was influenced by different levels of nitrogen and plant spacing. Although the highest aggressivity value (0.559) was found from the rice which was fertilized with 80 kg N ha^{-1}, it was at par with that of 100 kg N ha^{-1}, 60 kg N ha^{-1} and 120 kg N ha^{-1} (Fig. 2). The lowest aggressivity value (0.388) was observed when no nitrogen was applied onto the crop. Application of nitrogen at the rate of 60 kg ha^{-1}, 80 kg ha^{-1} and 100 kg ha^{-1} showed similar aggressivity values in both the growth stages. Almost alike result was observed by Park *et al.* (2002), who observed similar influences of nitrogen doses on the competitive power of rice varieties. Vasquez *et al.* (2008) observed increased competitive ability of cheatgrass when nitrogen fertilizer was applied properly.

The effects of plant spacing were found significant on the aggressivity values of BRRI dhan30. The highest mean aggressivity value (0.529) was noted when crop was planted at 25cm×15cm spacing which was identically followed by 20cm×10cm and the lowest aggressivity was found under the plant spacing of 30cm×20cm (Fig. 3).
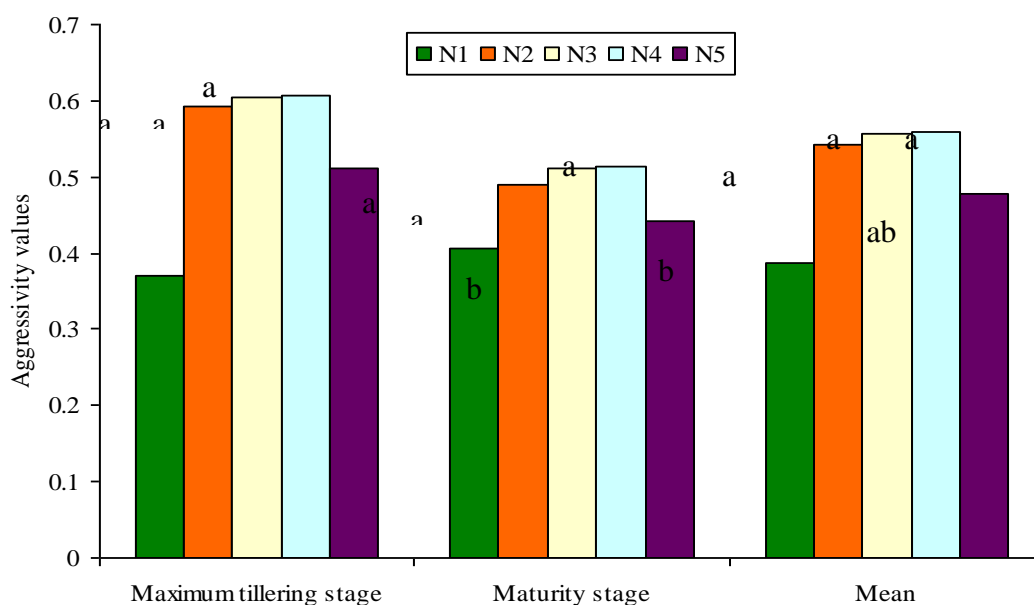
Fig. 2. Aggressivity of BRRI dhan30 at different stages as influenced by nitrogen doses

(N1=0 kg N ha-1, N2=60 kg N ha-1, N3=80 kg N ha-1, N4=100 kg N ha-1, N5=120 kg N ha-1. The bars having similar letter(s) do not differ significantly whereas figure having dissimilar letter(s) differ significantly as per DMRT).
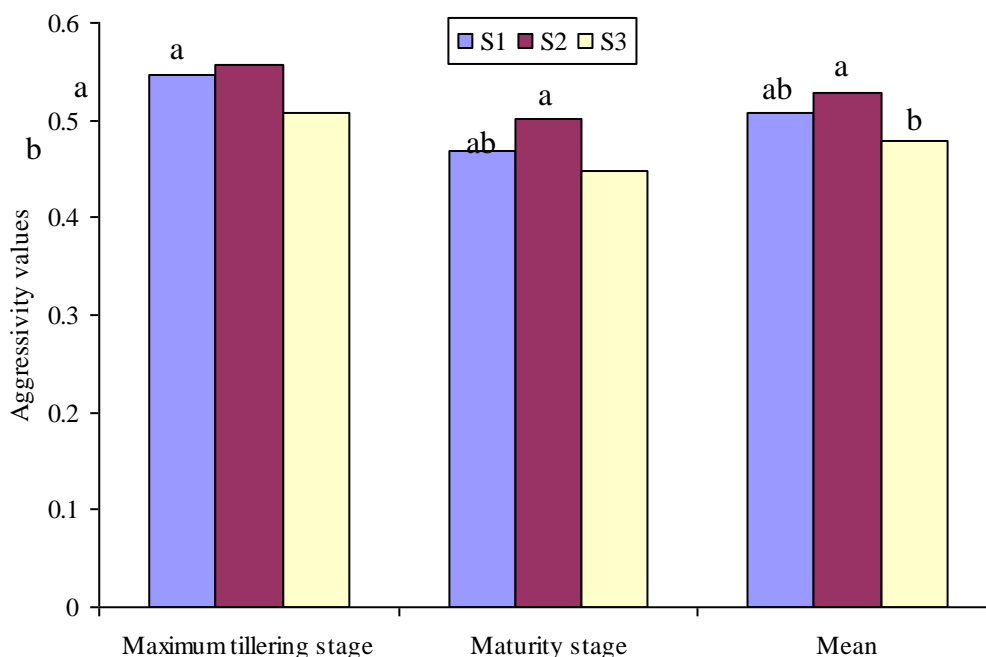

Fig. 3. Aggressivity values of BRRI dhan30 at different stages as influenced by spacing
(S1=20cm×10cm, S2=25cm×15cm and S3=30cm×20cm. The bars having similar letter(s) do not differ significantly whereas figure having dissimilar letter(s) differ significantly as per DMRT).

The interaction effect of nitrogen level and spacing on the aggressivity of rice was not significant. However, numerically the highest aggressivity (6.04) of BRRI dhan30 was found when the crop was planted with the plant spacing of 25cm×15cm and nitrogen dose of 80kg N ha^{-1}, while the lowest aggressivity was obtained from plant spacing of 30cm×20cm without nitrogen (Fig. 3). It should be noted that some plants are nitrogen-loving and some are not. The influence of nitrogen on the competitive ability of rice varieties might also be responsible for genetic makeup of the plants. Therefore it can be suggested that BRRI dhan30 should be grown with spacing of 25cm×15cm and nitrogen fertilization at the rate of 80kg N ha^{-1} in order to increase the competitive ability of the crop against barnyard grass.

4. Conclusion

BRRI dhan30 in Transplant Aman season (autumn) is one of the best competitive rice varieties especially where *Echinochloa crusgalli* and similar grass weeds might be a major constraint of rice production. The crop should be fertilized with 80 kg N/ha in the soil with medium and planted with a spacing of 25cm X 15cm in order to have higher aggressivity of the transplant aman rice.

5. Acknowledgement

References

Balyan, R.S., Malik, R.K., Panwar, P.S. & Singh, S. (1991). Competitive ability of winter wheat varieties with wild oats (*Avena ludoviciana*). *Weed Sci*. **39**: 154-158.

Blackshaw, R.E. & O'Donovan, J.T. (1993). Higher crop seed rate can aid weed management. In. *Proc. Brighton Crop Protec. Conf*. pp. 1003-1005.

BRRI. (2004). *Adhunik Dhaner Chash* (Modern Technique of Rice Cultivation) Booklet. Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur. pp. 8-45.

Chang, W.L. (1970). The effect of weeds on rice in paddy field. 1. Weed species and population density. *J. Taiwan Agril. Res*. 19(4): 18-25.

Chaudhury, A.N., Sharma, U.C. & Khan, A.K. (1995). Effect of weed management practices on nutrient reduction and yield of rice (*Oryza sativa*) in Nagaland. *Indian J. Agron*. 40(2): 192-193.

Christensen, S. (1995). Weed suppression ability of spring barley varieties. *Weed Res*. 24(2): 19-25.

Fairhurst, T.H. & Dobermann, A. (2002). Rice production in the global food supply. Rice Production Manual. Vol. 16 (Special supplement), May 2002, pp. 3-6.

Gibson, K.D., Fischer, A.J., Foin, T.C. & Hill, J.E. (2003). Crop traits related to weed suppression in water-seeded rice (*Oryza sativa* L.). *Weed Sci*. 51(1): 87-93.

Gomez, K.A. & Gomez, A.A. (1984). Statistical Procedure for Agricultural Research. John Wiley and Sons, Inc. USA.

Karim, S.M.R. (1991). Competitive ability of spring wheat varieties of wheat against fathen. PhD thesis submitted to the Department of Agriculture, University of Aberdeen, Scotland, UK.

McGilchrist, C.A. & Trenbath, B.R. (1971). A revised analysis of plant competition experiments. *Biometrics*. 27:659-671.

Park, S.K., Kim, K.H., Shin, X.R. & Pyon, J.Y. (2002). Differential competitive ability of rice varieties against barnyard grass in dry direct-seeded rice. *Korean J. Weed Sci*. 22(3): 266-271.

Tironi, S.P., Galon, L.; Concenço, G., Ferreira, E.A., Silva, A.F., Aspiazú, I., Ferreira, F.A., Silva, A.A. & Noldin, J.A. (2009). Habilidade competitiva de plantas de arroz com biótipos de capim-arroz resistente ou suscetível ao quinclorac (Competitive ability of rice plants with barnyard grass biotypes resistant or susceptible to quinclorac). *Planta daninha* [online] 27(2): 257-263. Available from: http://dx.doi.org/10.1590/S0100-83582009000200007.

Vasquez, E., Sheley, R. & Svejcar, T. (2008). Nitrogen Enhances the Competitive Ability of Cheatgrass (Bromus tectorum) Relative to Native Grasses. Invasive Plant Science and Management, 1:287–295.

Wallinga, J. & Van Oijen, M. (1997). Level of threshold weed density doesn't affect long-term frequency of weed control. *Crop Protec*. 16: 273-278.

Wilson, B.J., Wright, K.J., Brain, P., Clements, M. & Stephen, E. (1995). Predicting the competitive effects of weed and crop density on weed biomass, weed seed production and crop yield in wheat. *Weed Res*. 35: 265-278.

The Model of Contemporary Public Organization Management: A Case Study of Provincial Police Region 9

Tanarwad Wisamitanan

29 Moo 8, Koh Yor, Mueang, Songkhla 90000 Thailand

Ornpapha Chutikorntaweesin

National Researcher, National Research Council Thailand
67/80 Moo 12, Bangmaenang, Bangyai, Nonthaburi 11140 Thailand
E-mail: ornpapha.chu@gmail.com

Thuchapon Yodthong

National Researcher, National Research Council Thailand
67/80 Moo 12, Bangmaenang, Bangyai, Nonthaburi 11140 Thailand
E-mail: thuchapon.yodthong@gmail.com

Prapas Siripap

National Researcher, National Research Council Thailand
178/1 Moo 1,Nakhonchaisi, Nakhonchaisi, Nakhonpathom, Thailand 73120 Thailand

Veera Ladnongkun

National Researcher, National Research Council Thailand
8/86-87 Moo 9 Pornprapanimit Road, Banglamung, Chonburi, 20150 Thailand

Abstract

The purposes of this research were to study the components of new public management, the change management and innovation, and the good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9, to study the causal relationship between new public management, change management and innovation, and the good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9.   The results showed that the samples prioritized good governance with the highest mean, followed by change management and innovation, and new public management respectively. The components of new public organization, the components of change management and innovation, the components of good governance; all these three components have an influence on model of contemporary public organization, which is relevant to the hypotheses, by the correlation can predict model of contemporary public organization at 48.00%, 39.60% and 48.30% respectively. The analysis results were found that the model of the causal relationship between the components of new public organization, the components of change management and innovation, the components of good governance with model of contemporary public organization: a case study of Provincial Police Region 9, are relevant to the empirical data, considering from χ^2/df which is less than 2 (χ^2 / df = 1.65), GFI which is more than .90 (GFI = .91), AGFI which is more than .80 (AGFI= .88), and RMSEA which is less than .05 (RMSEA= .044).

Keywords: New Public Management, Contemporary, Public Organization, Change Management , Innovation Organization , SEM

Introduction

The development system of capitalism in the free world and the globalization lead to the alteration in the structure and relationship of economic, trading, social, culture, the technology development of the international organization. This connects our world to the context of discontinuous change (Kangsanan, 2007). This change covers the organization, the structure, the human resources and the technology, which nowadays the information technology has high influence and power. This is the challenge of the organization to adapt itself to the changing situation for surviving (Dessler, 2000).

The results of the change lead to the new public management: NPM aiming to the customers and the results, prioritizing the decentralization, the organization structure, and the mechanism in service (Aucoin, 1996; Hood, 1991; Osborne & Gaebler, 1992 as cited in Lhorsuwannarat, 2005). Including with applying the concept of management of private sector to the public sector occurred the paradigm of the new public (Boston, 1991; Stiglitz, 1994; Hon, 1995) for developing the public organization to be more contemporary, the public organization is important to the development of the country. The government uses many resources in improving the public organization to enforce the law, to build the system and mechanism for supporting the working process (Lhorsuwannarat, 2006).

The Provincial Police Region 9 under the control of Royal Thai Police have the responsive area in the four provinces of the southern part of Thailand consisting of Songkhla, Satul, Trung, and Pattalung, their main duty in working following the strategies plan of Royal Thai Police 2012 – 2021 and the four-year government plan of Royal Thai Police 2012 – 2016 consisting of 4 strategies; 1) to upgrade the performance to satisfy the government policy; 2) to develop the work of police to be transparent and up to standard; 3) the participation of people and the work connection; and 4) to strengthen the management to drive the organization to the vision "be the professional police for the happiness of people". It is very necessary that police have to cope with the change along with the management with core value; competency of officers in working, the transparency, the overall fairness by the principles of good governance holding the people oriented in working for the happiness and have service mind (Wongthanawasu, 2014).

Therefore the researcher, working in the Provincial Police Region 9, saw the importance to manage the organization to be updated and effective, and having high competency, and decided to study the contemporary management of the government organization: a case study of Provincial Police Region 9 for studying the model of the modern organization management which has the good management, officers, and happiness, the desirable organization of officers, people and society.

Purposes of the Study

1.   To study the components of the new public management, of the change management and innovation, and of good governance influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

2.   To study the causal relationship between the new public management, the change management and innovation, and the good governance influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

Research Hypotheses

1. There is statistical significance in the variables components of the new public management influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

2. There is statistical significance in the variables components of the change management and innovation influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

3. There is statistical significance in the variables components of the good governance influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

4. There is statistical significance in the relationship between the new public management, the change management and innovation, and the good governance influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

5. There is statistical significance in the causal relationship between the new public management, the change management and innovation, and the good governance influencing the model of the contemporary public organization: a case study of Provincial Police Region 9.

Literature Survey

2.1 The concept of new public management

Kreuthep (2004) presented the main idea of the concept of new public management as follow; 1) Prioritize the professional management, 2) Emphasize setting clear objectives of official work, 3) Connect the achieve of work with public resources management and support the reward system, 4) Improve the organization structure and work system to be smaller and flexible, and effective, 5) Support the contestability of the public management, 6) Modernize the management method and support the application of technology and business-like management in public administration, 7) Support the financial discipline, and use the resources to get the highest results to the public.

Noiwad (2013) presented the concept of new public management that the tool of government system should update the data and innovation to be knowledge both explicit and tacit; thus, the knowledge management is used as a tool in the government administration nowadays for that the organization develops the knowledge together with the operation.

New public management is as the seven following method; 1) Provide the quality service to people, 2) The recognition of people need, 3) The government should mind their own business, 4) The reduction of the control from central government and increase the freedom to each organization, 5) The work system aiming to the results, 6) The support of the personnel and technology, 7) Emphasizing the competition between the public and private organization.

2.2 The concept of change management and innovation

Hart (1996) presented the concept about the management of change in police organizations, and concluded that a macro model of organizational change is advanced which provides a structure for the analysis. The model is based on the significance of the 'stimulus' for organizational change, the 'target' for such changes and the 'types and stages' of change implementation. A manager's process model of change is suggested and the concept of a 'change counter resistance system' is introduced. Likely explanations for resistance to organizational change are advanced in order to help foresee and plan for minimizing the potentially negative effects of resistance to change.

Schermerhon (2005, as cited in Posew, 2010) noted that change management aims at 5 main goals; 1) The working style has to be changed; including regulation, goals, strategies, and new working design, 2) The personnel; the viewpoint and the performance of officers, human resources management system of the organization support hard work of the officers, 3) The organization culture, value, regulation which lead to new desirable behavior of each officer and teamwork, 4) Technology; working system and the information technology support the organization work, 5) The organization structure, the command line and the communication in the organization.

Innovation Center for Developing Thai Government System (2012) defined the word managing innovation of public sector that it is the concept, the method and the new type in organization development, the work process, and the service delivery; which is the results of the

development, the increase, the application of knowledge and other regulation; these enable the development of effectiveness, the efficiency, the work quality of public sector.

The managing innovation of public sector is framed by the role and functioning of government, which can be classified as follow; 1) Strategy/ business concepts innovation; 2) Service and product innovation is to improve, to change the appearance and the design of product and service; 3) Delivery innovation; 4) Process and organization administration innovation; 5) Process interaction innovation.

2.3 The concept of good governance

The good governance is the rule to administrate the country according with the meritocracy, the administration with morality and the good rule based on the accuracy; this is an important concept for current administration and management; and practicable, stable, transparent, having ethics in profession. Everyone in the organization can participate in sharing their opinion. Every work process can be verified. Everyone has to be responsible to their own action, to worthily use the resources, to have effectiveness in order the society to live together happily on the base of fairness and accuracy. The people could be the center leading to the sustainable development (Kaewphichit, 2008; Burikul, 2006).

The Buddhism has taught about the good governance since the Buddha era. Considering the teachings of the Buddha, the good governance is relevant to the new public management which was continually used; even it is not much different in the other religion. There are many teachings indicating the use of good governance: to be ideal person would lead the society to be peaceful consisting of 7 characteristics (P.A. Payutto, 1998) as the principles of Sappurisa Dhamma or 7 Virtuous Qualities: knowing the law; knowing the cause, knowing the meaning; knowing the purpose; knowing the consequence, knowing oneself, knowing how to be temperate; sense of proportion, knowing the proper time; knowing how to choose and keep time, knowing the assembly; knowing the society, and knowing the individual; knowing the different individuals.

The United Nations Development Programme's (UNDP) (1997) definition of good governance is set out that governance can be seen as the exercise of economic, political and administrative authority to manage a country's affairs at all levels. It is explained that governance has three dimensions: economic, political and administrative. Economic governance includes the decision-making processes that affect a country's economic activities and its relationships with other economies. Political governance is the process of decision making to formulate policy. Administrative governance is the system of policy implementation.

2.4 The concept of the organization of happiness

Limkreangkrai (2013) presented the concept about "Happy workplace" that it is a new concept in Thailand; it is to open the horizon to be interested in "life quality" of the officers covering the balance of physical and mental health, the soul, and the society. Petchrat (2011) also presented the concept about creating happy workplace that happiness means the personal assessment that how individual is fond of the overall of life; that we say we are happy means we are fond of or satisfy with our life. The happy people hardly have anxiety about their life; they love to enjoy with their friends and have new experience and stable emotion, and hope to find the good things in the future (Veenhoven, 1997).

To create the happy workplace or the organization of happiness requires 3 principles; 1) The officers are happy; to prioritize the officers in the organization which enables them to sacrifice and loyal to the organization; 2) The livable workplace; to create the good atmosphere at the workplace leading to the happiness in the workplace; and 3) The peaceful workplace; to create love and harmony in the organization. UNDP to indicate the advance of human, called the eight happiness; Happy body, Happy heart, Happy relax, Happy brain, Happy soul, Happy money, Happy family, Happy society

Research Methodology

Both quantitative and qualitative methods were used in conducting this research; Primary data were derived from the research questionnaires, responded by 336 samples of populations. The secondary data were from books, academic articles, journals, previous researches, and other reliable references. The statistics used in this research were frequency, percentage, mean, standard deviation, the hypotheses testing, and the structural equation model: SEM and the in-depth interview of the key informants.

Results of Research Findings

Demographic profiles

With regard to the demographic profiles, the results show that from the total number of 336 samples, 134 samples or 39.90% aged between 46-55 years old, 149 samples or 44.30% graduated Bachelor's Degree, 210 samples or 62.50% was Squad Leader, and 152 samples or 45.20% have worked for 11 – 20 years respectively.

The components factors in this study

With regard to the components factors of this research, the results show that in total the components factors is at the highest level with mean score of 4.58 (S.D. = 0.362). In particular, good governance is at the highest level with mean score of 4.63 (S.D. = 0.398), followed by change management and innovation with mean score of 4.59 (S.D. = 0.419), and new public management with mean score of 4.56 (S.D. = 0.392) respectively (see table 1).

Table 1: Mean and Standard Deviation of the Components factors in total

Components	$\overline{X}$	S.D.	Translation	Ranking
New public management	4.56	.392	highest	3
Change management and innovation	4.59	.419	highest	2
Good governance	4.63	.398	highest	1
Total	4.58	.362	highest	

Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of New Public Management and the Model of Contemporary Public Organization

With regard to the correlation between 14 variables, the results show that the correlation is in positive showing the compatible relationship, by that every variable have the relationship with the statistical significance at the level of .01. The correlation between the variables of the components of the hidden variables has the correlation in positive with high number, showing that these variables are the components of the hidden variables which is related to the concept and theory of relationship between the components of new public management and the model of contemporary public organization created by the researcher (see table 2).

Table 2: Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of New Public Management and the Model of Contemporary Public Organization

Variables	PRO	RES	ALO	MOB	SER	MOD	COS	PAR	CON	ACH	CAR	FRE	ASS	REC
PRO	1.00													
RES	.327**	1.00												
ALO	.322**	.408**	1.00											
MOB	.327**	.567**	.406**	1.00										
SER	.289**	.381**	.508**	.438**	1.00									
MOD	.158**	.305**	.256**	.506**	.409**	1.00								
COS	.246**	.252**	.324**	.341**	.550**	.441**	1.00							
PAR	.221**	.282**	.275**	.307**	.287**	.506**	.470**	1.00						
CON	.264**	.308**	.339**	.324**	.357**	.365**	.391**	.392**	1.00					
ACH	.302**	.317**	.374**	.428**	.353**	.389**	.298**	.377**	.677**	1.00				
CAR	.340**	.307**	.426**	.397**	.428**	.424**	.399**	.403**	.662**	.679**	1.00			
FRE	.391**	.341**	.392**	.461**	.474**	.376**	.414**	.356**	.580**	.537**	.572**	1.00		
ASS	.331**	.400**	.396**	.525**	.494**	.370**	.317**	.375**	.534**	.621**	.592**	.660**	1.00	
REC	.352**	.394**	.437**	.446**	.422**	.386**	.418**	.410**	.599**	.570**	.610**	.753**	.694**	1.00

** Statistical Significance at the Level of .01

Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of Change Management and Innovation and the Model of Contemporary Public Organization

With regard to the correlation between 13 variables, the results show that the correlation is in positive showing the compatible relationship, by that every variable have the relationship with the statistical significance at the level of .01. The correlation between the variables of the components of the hidden variables has the correlation in positive with high number, showing that these variables are the components of the hidden variables which is related to the concept and theory of relationship between the components of change management and innovation and the model of contemporary public organization created by the researcher (see table 3).

Table 3: Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of Change Management and Innovation and the Model of Contemporary Public Organization

Variables	MIN	TEC	FLE	INN	KNO	CHA	COR	CON	ACH	CAR	FRE	ASS	REC
MIN	1.00												
TEC	.483**	1.00											
FLE	.542**	.606**	1.00										
INN	.466**	.521**	.598**	1.00									
KNO	.448**	.449**	.601**	.520**	1.00								
CHA	.317**	.330**	.416**	.446**	.454**	1.00							
COR	.319**	.395**	.413**	.379**	.554**	.466**	1.00						
CON	.406**	.274**	.403**	.284**	.379**	.327**	.454**	1.00					
ACH	.432**	.344**	.421**	.403**	.397**	.337**	.420**	.677**	1.00				
CAR	.356**	.377**	.401**	.324**	.334**	.272**	.424**	.662**	.679**	1.00			
FRE	.352**	.315**	.341**	.342**	.464**	.370**	.458**	.580**	.537**	.572**	1.00		
ASS	.307**	.353**	.377**	.374**	.470**	.374**	.446**	.534**	.621**	.592**	.660**	1.00	
REC	.331**	.316**	.362**	.348**	.454**	.348**	.462**	.599**	.570**	.610**	.753**	.694**	1.00

** Statistical Significance at the Level of .01

4.5 Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of Good Governance and the Model of Contemporary Public Organization

With regard to the correlation between 12 variables, the results show that the correlation is in positive showing the compatible relationship, by that every variable have the relationship with the statistical significance at the level of .01. The correlation between the variables of the components of the hidden variables has the correlation in positive with high number, showing that these variables are the components of the hidden variables which is related to the concept and theory of relationship between the components of good governance and the model of contemporary public organization created by the researcher (see table 4).

Table 4: Correlation Analysis between Noticeable Variables in the Form of Relationship between the Components of Good Governance and the Model of Contemporary Public Organization

Variables	RUL	MOR	TRA	PAT	ACC	ECO	CON	ACH	CAR	FRE	ASS	REC
RUL	1.00											
MOR	.552**	1.00										
TRA	.518**	.481**	1.00									
PAT	.421**	.520**	.479**	1.00								
ACC	.291**	.273**	.336**	.312**	1.00							
ECO	.347**	.310**	.393**	.406**	.642**	1.00						
CON	.380**	.284**	.391**	.346**	.556**	.522**	1.00					
ACH	.360**	.349**	.419**	.318**	.398**	.487**	.677**	1.00				
CAR	.369**	.432**	.438**	.397**	.414**	.486**	.662**	.679**	1.00			
FRE	.407**	.318**	.386**	.401**	.450**	.480**	.580**	.537**	.572**	1.00		
ASS	.371**	.275**	.346**	.315**	.307**	.504**	.534**	.621**	.592**	.660**	1.00	
REC	.431**	.355**	.414**	.404**	.431**	.520**	.599**	.570**	.610**	.753**	.694**	1.00

** Statistical Significance at the Level of .01

4.6 Model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9 (developed)

With regard to the analysis of the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9, according to the research model, the noticeable variables in each hidden variables of this model are the real components, by that every components in this model have the weight components higher than .25 (see figure 1).

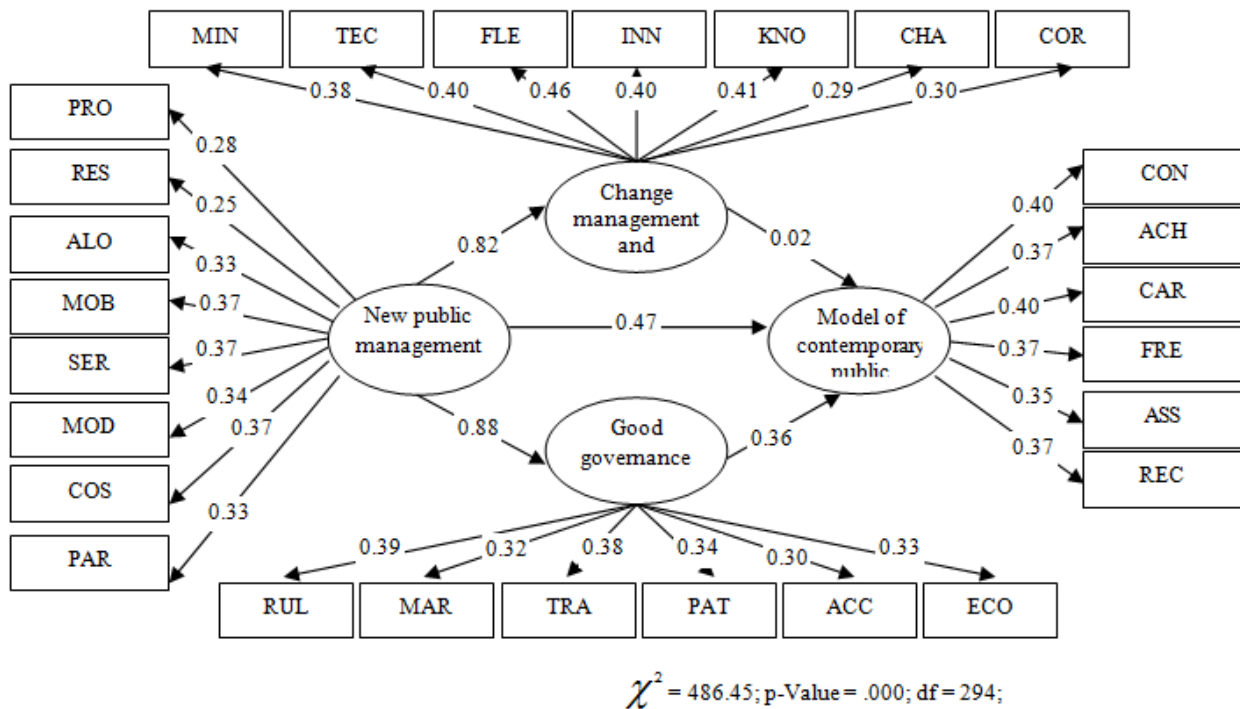$$\chi^2 = 486.45; \text{p-Value} = .000; df = 294;$$

Figure 1: the structure of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9 (developed)

With regard to the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9, which is relevant to the empirical data, considering from χ^2/df is not more than 2 (χ^2/df = 1.65), GFI is more than .90 (GFI = .91), AGFI is more than .80 (AGFI = .88), RMSEA is less than .05 (RMSEA = .044). Thus, the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9 is relevant to the empirical data (see table 5).

Table 5: concordant index of the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9 (developed)

Statistics types	Statistic
χ^2	486.45
p-Value	.000
df	294
χ^2/df	1.65
GFI	.91
AGFI	.88
RMSEA	.044

Conclusion and Discussion

The result of correlation is that the components of new public management, of change management and innovation, and of good governance have the relationship with the model of contemporary public organization with the statistical significance at the level of .01, which is relevant to the hypotheses.

The results of the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9, which is relevant to the empirical data, considering from χ^2/df is not more than 2 (χ^2 / df = 1.65), GFI is more than .90 (GFI = .91), AGFI is more than .80 (AGFI = .88), RMSEA is less than .05 (RMSEA = .044). Thus, the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization: a case study of Provincial Police Region 9 is relevant to the empirical data.
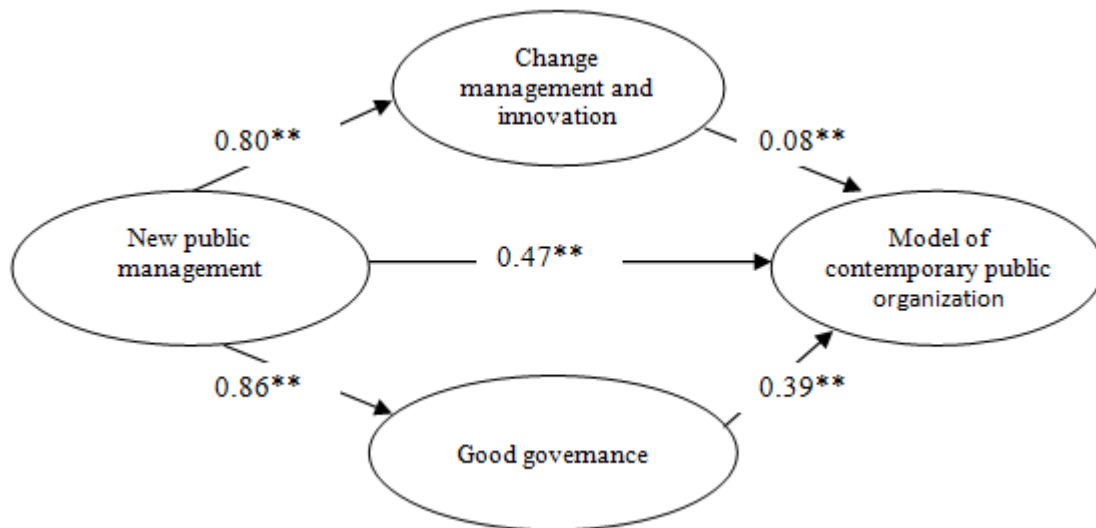

Figure 2: the model of the causal relationship between new public management, change management and innovation, and good governance influencing the model of contemporary public organization created by the researcher

With regard to the components of new public management, the samples prioritized update the methods of management and apply the information technology in the organization, which is necessary for public management and also relevant to the concept of Khreuthep (2004) that the managing method should be modernized and the technology and the technique of private sector should be applied in public management in the method of business-like management. Moreover, this is relevant to the concept about new public management of Noiwad (2013) that the tool of government system should update the data and innovation to be knowledge both explicit and tacit; thus, the knowledge management is used as a tool in the government administration nowadays for that the organization develop the knowledge together with the operation, the research results are relevant to the vision of the key informants; Pol. Col. Nipol Hemsalamad (interview on 31st March 2014) that "… the new public management is to apply the business management, to respond to occur the perception to the customers and to use the new management such as to find the cooperation from local people, the relationship between the police and people and also other local organization…" Pol. Col. Chtphisit Nakharawong (interview on 1st April 2014) also shared the relevant opinion that "… the image of the new public management in the past used the managing system that permit the

participation of the subordinates and people mainly aiming at the results more than the process. This is also relevant to the concept of Pol. Col. Boonrod Nanthasut (interview on 31st March 2014) that "…For the direction of new public organization, Royal Thai Police appoints all police organization to professionally work relying on the theory of economy efficiency, all superintendents should have leadership to create good relationship with community; if there should be any change in the community, police should declare to the stakeholders and people to let them know and prepare to the changes…" Schermerhorn (2005, as cited in Posew, 2010) also said that the change management should aim at technology, working system, and the information technology to support the working system in the organization. In addition, the research results are that the components of change management and innovation, the samples prioritized having good organization culture ready for leading the change, this is relevant to the concept of Phinaisap (2013) that the next decade is the decade of innovation, thus innovation will take an important role to create the competitive capability of both public and private sectors, therefore the organization should prioritize the innovation management for cultivating the attitude about organization culture and the working process. In the aspect of innovation, Pol. Col. Nipol Hemsalamad (interview on 31st March 2014) presented that "…it is explicitly seen that the thinking innovation and technology always change to that the subordinate can participate, share their opinion. The use of technology is such as using online media in communicating, the letter can be enforced without to wait the policy for satisfying in time, it can fast respond to the order of the commander. The innovative change emphasized the individual to be awake, ready, and use the changes to make profit to the organization…"

In addition, Pol. Col. Decha Kanchanasorat (interview on 1st April 2014) shared additional opinion about change management that "…An importance of change management for becoming good organization is that the personnel in the organization should firstly have good point of view, the management under the organization conditions and regulations, the morality, the organization of learning to develop the officers to be knowledgeable …" This is also relevant to Burikul et al. (2002) that the principles of good governance, according to the Phrapokklao Institution, the value of money, considering the highest benefit of people to well manage the limited resource, consisting of

1) The economizing

2) Use the limited resources to earn the highest benefit

3) The competitiveness

From these can be concluded that the contemporary public organization has to adjust itself to be relevant to the current situation from the managing structure, technology including the human resources to be up-to-date and responding to the expectation of people toward the public organization, especially the police. Pol. Col. Chtphisit Nakharawong (interview on 1st April 2014) also shared the relevant opinion that in the aspect of good governance, the principle of participation of people sector and the subordinate to set the committee to create the activities; everyone is equal to participate in every process, the results would be appreciating…" With regard to model of contemporary public organization, the aspect with the highest mean is good management system; another aspect with the highest mean is good management system, good and happy officers; this is relevant to the concept about organization of happiness of Limkreangkrai (2013) that it is not only the administrator who should change, but also the organization personnel has to be ready by developing the performance to cope with the changes and be concerned about "life quality" in the aspect of physical, mental, soul, and society for becoming "organization of happiness". "Happy" is relevant to the concept of Witthayaphan (2013) that the organization of happiness is the organization that enables the personnel to feel good, to impress, and to be proud to work in the organization. When there is the happiness, the power of heart occurs, and this power of heart will lead to the successful work complying with the goal of the organization. In addition, Pol. Col. Athip Sangwanloy (interview on 31st March 2014) also shared his opinion about the aspect of innovation that "… the innovation about new technology can be applied in creating happiness in workplace, the

people participation, the resolution of the commander…" This is relevant to the perspective of Pol. Col. Sumit Srinual (interview on 1st April 2014) that "…the new public management influencing model of contemporary public organization, the management structure from Royal Thai Police, when it was practically used, it depended on the administrator of each organization, and on each situation. Nowadays the principles of law is not enough, there also should be the principles of politics, the professional, and the new technology…"

Recommendations

1. The public organization in Thailand should apply the results in developing the new public management for being professional management aiming to the results the flexibility, the quality, the modernity, the efficiency, and the opportunity of people participation to be the model of contemporary organization.

2. The public organization in Thailand should apply the results in managing the change and innovation to develop the service and technology, the innovation support and knowledge in organization in order to have good organization culture to be the model of contemporary organization.

3. The public organization in Thailand should apply the results in developing the good governance with the law, the morality, the transparency, the participation, the responsibility, the efficiency to be the model of contemporary organization.

4. The research results result should be used as the direction to develop the performance to be the model of contemporary organization emphasizing the relationship between the public sector and people, the systematic management system, the transparency, and the people participation.

5. There should be additional study about other factors components.

6. There should be the comparison study between public organization in Thailand and in ASEAN for developing toward the organization of good governance and happiness and can upgrade to be the model of contemporary organization in the future.

References

Athip Sangwanloy (interview on 31st March 2014)

Boonrod Nanthasut (interview on 31st March 2014)

Boston, J. (1991). The Theoretical Underpinning of Public Sector Restructuring in New Zealand, in Reshaping the State: New Zealand's Bureaucratic Revolution. Auckland: Oxford University.

Burikul, T. (2006). Good Governance: the Principle for New Public Management. Nonthaburi: Phapokklao Institution.

Chtphisit Nakharawong (interview on 1st April 2014)

Decha Kanchanasorat (interview on 1st April 2014)

Dessler, G. (2000). Human Resources Management. 8th ed. New Jersey : Prentice – Hall.

Hart, J. M. (1996). The Management of Change in Police Organizations. Policing in Central and Eastern Europe: Comparing Firsthand Knowledge with Experience from the West. College of Police and Security Studies · Ljubljana, Slovenia.

Horn, M. J. (1995). The Political Economy of Public Administration: Institutional Choice in the Public Sector. Cambridge: Cambridge University.

Innovation Center for Thai Government Development, (2012). Retrieve from http://www.opdc.go.th/psic/main.php?url=content &gp=1& mn=3.

Kaewhijit, S. S. (2008). The Use of Good Governance in Private Educational Institution. Dissertation, the Branch of Education Management. Silpakorn University.

Kangsanan, G. (2007). Management of Change Organization: Viewpoint of Process and Behavior Integration. *Journal of Phapokklao, 5*(2).

Khreuthep, V. (2004). New Public Organization: The Empirical Evidence of the Performance of Local Administration Organization, the Academic Conference of High-Area Political Science: Reform of Thai Local, 27 – 28 August 2004.

Limkreangkrai, C. (2013). The Development of Change Leader in Creating Happiness. Retrieve from http://www.happy-workplace.com/userfiles/**151.**pdf.

Lhorsuwannarat, T. (2005). Organizational Theory: the Development and Challenge in the Future, 50 years of Faculty of Political Science. National Institute of Development Administration. Bangkok: Siamthongkit.

Lhorsuwannarat, T. (2006). The Factors of the Form of New Public Organization. National Institute of Development Administration.

Nipol Hemsalamad (interview on 31st March 2014)

Noiwad, O. (2013). Knowledge Management with New Public Management. *Mini Online Journal of Health and Science, 1*.

Osborne, D. and T. Gaebler. (1992). Reinventing Government: How the Entrepreneurial Spirit Is Transforming the Public Sector. Reading, MA: Addison-Wesley

P.A. Payutto. (2010). Life Constitution. Bangkok: Sahadhammig Publishing.

Petchrat, K. (2011). Happy Workplace Creation. Faculty of Health and Sport Science, Thaksin university.

Posew, B. (2010). Change Management: the Role of the Communication inside the Organization. School of Humanities and Applied Arts. University of the Thai Chamber of Commerce.

Stiglitz, J. E. (1994). Whisher Socialism?. Cambridge, MA: MIT Press.

Sumit Srinual (interview on 1st April 2014)

UNDP. (**1997).***Governance for Sustainable Human Development, A UNDP policy document***.Retrieved from http://magnet.undp.org/policy/chapter**1.**html.

Veenhoven**. (1997).** http://www.happinometer.ipsr.mahidol.ac.th/pdf/ HAPPINOMETER_%E**0%B8%**AD.%E**0%B8%**A8%E**0%B8%**B4%E**0%B8%**A3%E**0% B8%**B4%E**0%B8%**99%E**0%B8%**B1%E**0%B8%**99%E**0%B8%**97%E**0%B9%8**C_0811 **12_**chiangmai.pdf.

Wongthanawasu, S. (2014). San Na Meng Municipality's Potential to Develop Sustainable Life Quality of Children, Youth and Families in the Local Community. Graduate Research Conference 2013 . Khonkaen University.

The Dictatorship of the Arab Leaders and the Arab Spring

Dr. Riyad Mofleh AL-Khlaifat

Assistant Professor of Political Science (International Law),
AL-Balqa' Applied University

Dr.Riyad Mofleh Al-khaifat
Riyadmof1967@yahoo.com

Abstract
The change movements can now be distributed into three groups. The first one is considered to be delightful such as Tunisia and Egypt and some of them as disturbing such as Yemen ,Libya and Syria and most recently was sad such as Bahrain where the matter turned out to be based on a sectarian rankings. There is no doubt that the popular movement and all what it can follow was and will be within endemic Arab societies with the diseases of tribal, sectarian and ethnic backwardness as well as the domination projects of discord, division and internationalization.

Key words

1- Arab Spring : Arab revolution

2- Mohammad Bouazizi: explosive volcano man

3- Arab Street: the people who lead outcry

4- The individualism: leads to corruption and violence

5- dictatorship : produced the republics of coups

6- Middle East: Arab countries

Introduction:

We haven't heard or read one day that one of the Arab leaders became a president unless through the bloody coups. After that, they started killing and executing all people who were in the authority including the presidents , the ministers and even the postman.

None of the them became a president through the ballot boxes and what is surprising in this case is that ,some of them declared the coup on the property and the state has turned to the constitution and the Republic, however the family took their role one after the other.

In addition to that, anyone who arrived at the seat of the government , started making promises to the people such as, the renaissance, the progress , the restoration of democracy , the freedom for the state, the re-prestige of the state , adjusting salaries and jobs , talking with the opposed people and the re-drafting of the constitution.

The Arab leaders actually applied these promises, where they started through the arrests , the executions and the oppression of the people. Moreover, they started to crush their people in their living, judge them with fire and iron, fight freedom and democracy , interfere in the neighboring countries as well as to export the internal and external problems.

The Arab leaders curse against their people the colonialism and the Zionism ,whereas they take aids from them secretly in order to feel stronger against their people . All of these things has been done in the previous decades, until these words appeared in the social networking site[1].

" Oh Mum. I am travelling , please forgive me, what is the benefit of the blame it doesn't make sense, I am lost in a way out of my hands , please forgive me Mum if I disobeyed you or if I didn't listen well to your words, however it is the time to be blamed and not me , I am going without any idea of coming back. "

These words was written by the packman on the Facebook. He was a university graduate who couldn't find a job ,so that he used his small carriage to sell vegetables and fruits in a way that he could feed himself and feed his family. He was the Tunisian seller; Mohammed Bouazizi, who burned himself as a protest for the police who took him his small carriage and hit him , the result for that was the burning of the Arab regimes. Mohammad Bouazizi was not only a burning man ,but also he was an explosive volcano whose lava reaches all parts of the Arab world without exception[2].

There is no doubt that Mohammad Bouazizi, the educated man has been burning until he sparked a revolution that could awaken the poor Arab peoples as a whole which they inherited from Arab extinct eras . It was the legacy of submissiveness , subservience, weakness, obedience, despair , the spherical diet and the religious struggle.

Mohammad Bouazizi, this educated poor man by his burning and sitting in his bed with his burns showed the world that many of the Arab leaders to be very frightened for the first time in front of their people . They knew that it was the end of the story and the end of their regimes which were about to be broken down . However, the question is now ; Did the standing political entities and the entities ,that took place over the replaced regimes , have the courage on underestimating and ridicule of the poor.

The Arab people moved spontaneously refusing oppression and calling for freedom . They don't have neither political saying nor political program , however they arrived to the demand for falling the regime as an irreversible target . So that, the movement which was irrigated by the blood moved in the beginning socially and its main demand was the freedoms , in other words , without any conspiratorial dye. But now, the Arab grassroots hired some of the foreign powers , which lead the observers to be afraid of abduction the spark of the efforts of the Arab Street which was planted by sacrifices and watered by blood. This fear leads to permissible questions including, who is

[1] http://www.kitabat.info 23/10/2011 -Nabil Kassab. The fate of the rulers of the Arab regimes.
[2] http://www.kitabat.info 23/10/2011 -Nabil Kassab. The fate of the rulers of the Arab regimes.

responsible for the movement of the Arab Street now? ,what is after taking off the heads of the states?, what are the alternatives for the outstanding dictatorships in the case of the success of the popular movement? , what changed after the fall of the regimes is only the loss of security and the rule of the chaos? And what is the only constant role that Israel plays in the variables of the Middle East as well as, what is the role of the United States and the European powers?

We will try in this paper to summarize a description of what is happening ; that it is to say, is it actually revolts against corruption and if it were as such are they a mere of revolutions without any leaders or they are just the angry popular mobility whose demands are to achieve the social justice . If it was so, then who are the owners of patience in the mobility of the Arab streets or is all this Arab Spring demands a mere of a deliberate conspiracy from the ground up.

What are the reasons for the Arab Spring?

We will monitor briefly here two reasons for the mobility of the Arab Street and we will simply compare between the sound of the two Streets particularly the western and the Arab streets .

The Dictatorships of the Serial Defeats[3]:

Since the war ended in 1948 and the defeats and losses has been lasted concerning the Arab peoples. That defeat produced the republics of coups and bore the dictatorship of defeats that are still breeding to this day as to generate a successive defeats starting from loophole Darfssoar through the battles of Saddam and the subsequent destruction of Iraq and before that Egypt and Syria and after them Lebanon through the process of kidnapping and bargains to liberate the land from the sea to the river and ending up with the slaughter of Gaza by the Israeli machinery. Since that time, the countries and the peoples has paid the bill of trade out of these wars at the hands of a group of dictatorships since more than sixty years.

The economy of these countries and their people are considered to be the weakest in the region and their social situations are not constant . In addition to that, the highest levels of illiteracy, backwardness, unemployment and the fragility of their construction are spreading among their population in front of less than a crisis or a disaster as a result of the consumption of most of their moral and physical forces within random wars without any purpose just to maintain the regimes and their chairmen.

The history doesn't hide for us, how these regimes exhausted their internal fronts through wars with Israel after that within each other or with their peoples or their neighbors and what they produced of tragedies , retreating and the distortion of many of the national principles /concepts and even killing the feeling of citizenship and belonging as well as leaving their peoples facing their fate in unequal wars in terms of the number and the tools of wars with enemies who are tyrants.

Diseases and manifestations in the Arab street:[4]

The western/West Street is the voice of the voiceless, and the voice for the one who has a voice , are these the attributes of the Arab streets?

Certainly not! the Arab regimes don't pay attention to the Arab street , and don't take its demands and sometimes they do the opposite to that in order to prove to the others that they don't subject to the opinion of the Arab street.

The Arab society is considered to be an individual society not a collective one evidenced by the abolition of the role of the institutions and the civil society in addition to the strong focus on one leader , the leader of one unique policy in different forms (ownership, tribal, military) . Moreover, some of the Arab regimes deliberately try to cancel the opposition , and to deny it sometimes or to torture or imprison it or even it comes to kill it at the end of the story.

---

[3] http:// www.ahewar.org Kifah Mahmoud. The Civilized dialogue. Number 2526. 14/1/2009
[4] http:// www.ahewar.org Kifah Mahmoud. The Civilized dialogue. Number 2526. 14/1/2009

The violence has become one of the features of the manifestations of the Arab Street , it has reached to become a moral, economic and political value and this is no doubt due to that some of the Arab regimes went deeper within the socio-economic and political corruption to a great extent.

The corruption created violence and the later created destruction and if these regimes were based on the principles of compromise , understanding and collective reconciliation and contracting with their peoples and not on the basis of the violence and intimidation , the result will be totally different of what their peoples, regimes and societies are suffering from nowadays.

The individualism leads to corruption and corruption is the legal father for violence , so that once one screams against corruption , his voice will be cancelled either in prison or exile or death, and this is the one who gives the start to interact with the resistance of the regimes of the ruler and to mobilize the demonstrations and marches .

The failure of regimes in achieving the demands of their peoples to reach to the level of the social promotion is considered the main reason that makes the regime considers that any freedom of expression in the street is as a threat to the authority dealing with him from the political aspect. The number 99.9.

-The Arab street doesn't move until it reaches to the degree of boiling , despite the fact that this degree didn't reach through history to that level of expression .

We are accustomed that the real, audio, only, fake, funny and wailing voice for the Arab Street is entitled 99.9 ,so the requests of Street didn't enter one day within the decisions of the state and the decisions of the state couldn't match the demands of the Street.

A comparison between the western and the Arab street:

The western street moves when it reaches to the degree of gratitude and not of boiling because it said his word honestly for the controlling regimes and not out the ballot boxes, and what is important here that it moves to protest the state as it considers it its second line of defense for freedom and democracy , as a result of that the decisions of the state in this case comes parallel to the demands of their peoples .

As well as , the states are fully aware of the sensitive issues that require West Street, and the individual in the state is considered to be the most important member /element of all his elements of collective decision-making.

All in all, the wars , the individual regime, corruption and violence are the ones that are in charge of creating a new primary identity in the Arab world that is called the movement for social justice and the democracy so that ,what is our next destination after the Arab Spring.

What is after taking off the Arab presidents[5:]

The joint among the Arab countries is no longer a unit of language, culture, history and geography , but also it is the unit of the case in terms of the presence of corrupted governments , political depression , wide unemployment , social poverty and the absence of the employment opportunities for the new generation and this what made the street moves .however, what is to be done after the uprisings and taking off heads?!

Nowadays, Tunisia is a beautiful model and an excellent one of the quality for the style of the interior desired change in other Arab countries, in terms of insisting on the target and the continuation of the peaceful popular movement that rejects using the armed violence and keen also on the institutions of the national army and are ready for more sacrifices and outs of the bargains designed to make the change in people only particularly.

---

[5] http://www.alhewar.com , Subhi Ghandoor . Studies within an Arabic vision for Arabic variables

The change that took place in Tunisia took place in a harmonious society in all its religious and ethnic composition /structure without any denominational or ethnic purposes for that , so that, it is better than many Arab countries whose obsession is the geographical change in terms of the importance of the political change , for example, such as Yemen.

-Egypt found also itself faced with the maturity of change with its sister Tunisia. However, Egypt keeps quiet as the Nile, but when it erupts the flood happens. The revolutions of Egypt have been conspiring against , we will not forget the revolution of July 23, 1952 which was an Egyptian revolution of Arab issues , but after the death of Abdel Nasser the role of Egypt was cancelled and it returned to the bottleneck as it and the Arab nation lived thirty years after Abdel Nasser bad circumstances.

So that, the Arab world as a whole went on towards the revolution of January 25, 2011 and felt that Egypt is the beginning of a spark for the Arab renaissance that is because of the satisfaction of the Arab movement/grassroots that the Arab issue collapsed after Abdel Nasser and after Sadat's visit to Israel.

The president of Tunisia escaped , the president of Egypt stepped down and here on trail, the president of Libya was killed and the presidents of Yemen is trying to convince himself and the president of Syria resists and the whole world witnesses how all of these inherent vocabularies with the presidents have caused chaos and the absence of security in the society and this is a natural result since all the popular grassroots in the Arab countries take place on a torn land for a long period of time and among divided peoples within themselves nationally, religiously, ethnically and geographically.

However, it is no doubt that that there is an Arab valid yeast in more than one place and now it is suffering from the difficulty of circumstances and the lack of resources in addition to the poor climate and the pluralism, but these difficulties don't have to be led to despair rather than to the burning awareness that the mass movement needs to clear-cut prospects in addition to sound regulatory frameworks as well as it necessities faithful leaders to achieve the goals and not to fulfill their own objectives , and the question that rises here, are these elements are available in the apparent popular movements, and that what the majority of people who were silent want and that is why they have risen and for this reason they have demanded for the removal of their political regimes.

The alternatives of the outstanding dictatorships if the popular movement succeeded:
Up to now, the essence of the ideas and the nature of leaderships that stand behind this movement that the young Arab rebel played haven't cleared yet. The peoples are aware of only one thing that there are not going to sing a blank and that young people who sacrificed by themselves will not accept for his sound methods towards the social justice are to serve useless ideas and leaderships.

For this reasons, you can notice that the countries that dropped their regulations /regimes are now closer to the leaders and their reform programs in addition to their political narratives that lead all the country with all their differences towards the best .

Moreover, they are not just leaderships who wore masks coincided with the silent majority to overthrow the regime and dispersed when the time came to choose the alternative and to select the political programs due to their different goals and political narratives from the beginning.

This is the alternative to the regimes of dictatorship, it is a system/regime that is ready for the reform as well as ready to open a dialogue with the opponents in the form of the political form . It is a regime that knows that the opposition to corruption is strong that pay the street to demonstrate and unable to return him to his home.

It is a regime that doesn't arrest the demonstrators or kill them , thinking that by this way it will be able to frighten the grassroots and the silent majority . In addition to that, it is a regime that is

ready to open a dialogue with the people in terms of the rights and the duties and not ready for violating them.

Moreover, it is considered as a regime that push the movement in order to strengthen /or consolidate a national cultural mutual Arab identity that depends on the concept of loyalty and not the religious nor the ethnic belonging nor the ethnic asset and fueling the internal Arab conflicts . Besides that, it is a regime that doesn't manage projects of sedition or division or even internationalization of the countries in the region .

It is a regime that provides the minimum guarantees of security , the food, and the social and medical guarantees . it also ensures dealing with the problems of fear and hunger in the sense that the ticket election won't be captive for a living and the citizen is not afraid of expressing his electoral opinion .

Finally, it is a regime where the media will be a source for the neutral reportage and not the security and intelligent report and that is the reason behind the protest of peoples against the national media.

-This is the bright alternatives for a bright mobility whose only demand is to exceed the corruption, the injustice and achieve the social justice.

The role of Israel, the United States and the European powers in the variables of the Middle East:

In the beginning, we cannot ignore Israel and consider it as a neutral and an observer party at the same time for what is happening in its hostile Arab neighbors.

Since immemorial time, everyone knows that Israel has its own strategic programs that won't give up them at the top of which is the clastic project of the Arab countries on the bases of sectarian and ethnic as to prevail as a strong power and for the Jewish religion to prevail with it . Israel is good at the employment of the official Arab mistakes , the international circumstances and the American projects in the region especially in this period of political, security and geographical transformations. Israel hopes to transform the regions of the Arab revolutions to the areas of civil war and on the religious and ethnic bases in order to push the region to a state of division and

internationalization as well as to achieve one result that is to cooperates with the powers that have the same interest with ti in the Middle East in order to control the sources of wealth and the best example of this what happened earlier this year of the internationalization of the Sudan case until we got to separate its north from its south.

-As for the American role in this case, the whole world watched the role of the U.S. administration in the Arab revolutions, because it is important to say, that the Arab revolutions is considered to be a pure domestic industry and not being imported from America . it stems from the suffering of the peoples of the region for long decades from authoritarian regimes in the home and which is not national in its foreign policy . It lives through the outer support and has the upper hand over their peoples as well as it looted its wealth and sank them with debts. Washington fell silent at the beginning of every revolution , but as the marks of victory for the fall of regimes started to appear , it immediately adopt a role as a patron and the supporter for the will of the oppressed peoples.

America is not a charity concerned with the human rights as it claims and it supports the change movements for the will of the oppressed peoples , it is a superpower whose standard is to search for its interests as well as guarantees for the continuation of these interests. America will not involve itself in wars in the Middle East for democracy because they have learned the lesson of Iraq and Afghanistan. America is in favor of the change in terms of people and governments in a country and to stay in another country and this depends on America's relationship with the existing institutions, especially the military ones. America is not alone, but international and regional parties

are now trying to pursue their interests in the Middle East through these revolutions, especially as the focus of international attention to Israel's existence which extends its influence to the decision-makers in the White House.

The issues that prompted Tunisia, Egypt, Yemen, Jordan, Syria, centered on political and economic reforms, the corruption of successive governments, and the lack of employment opportunities and America does not mind in order to change as long as it does not contradict with the foreign policies pursued by the ousted regimes with Israel. The hope held on this political change is the hope that must be in the interests of nations and Arabism and not in favor of Israel, and this will not be achieved unless by the last word of the Arabs themselves where the fate of their homes depends on them

The positives of this stage:

No one knows if the popular movements which happened in the Arab world are considered to be as a blessing or a curse, but here we will try to identify some of the positive aspects and achievements.

These revolutions have broken the barrier of fear that has prevailed for decades among the peoples of the region with the exception of the resistance movements against the interior occupation of any country .

These revolutions have confirmed the vital role of the Arab street and the people were re-considered in the processes of change required after they were for the preserve of the military institutions or the betting on the external intervention.

Theses sectarian divisions fell, as the developments trimmed the nature of divisions between the despotic ruler and corrupt governments, and among the convicted citizens who belong for all the oppressed sects.

The peaceful movement in every country of the revolution and the military institution's ability to compel its rulers to step down, as happened in Egypt and Tunisia, or the schism from them, as happened in Libya, Syria and Yemen is one of the positive models.

Lessons to be learned:

We will summarize here the lessons to be learned and understood out of all the elements and the leaderships of the popular movements on both the Arab and the national levels.

On the Arab level, by 2011,the whole world has awakened to one acclaim" the people want to overthrow the regime" after the Arab world wakes up to the cheers of the executioners of the Sultan , however, that this chanting demands to topple the regimes behooves us as an Arabic nation to shed light on what is to come:

In 1971, Egypt and Libya announced the Federation of the Arab Republics , but the experiment failed after the 1973 war. How much is an urgent need now to declare the union of the revolutionary Arab Republic after the success of this region to change their regimes , or at least the level of coordination and cooperation rises to the current stage.

This announcement is for autism to restore security and stability to the Arab territories without foreign interference controls the wealth of nations and threatens to cut aid.

The pluralism in the Arab countries in the fifties and sixties was a source of pride to fight the battles of independence and liberation against colonialism and it was characterized by an Arabic nature , now let's try to bring it back and we do not want it now as a barrier among the peoples and as an obstacle.

In the past four decades, the Arabs tried the approach of Arabism until Al-Sadat visited Israel in 1977 and the coup started on the approach of Arabism in both Egypt and the Arab world. Today

and after these revolutions , we want to make the countries join within an Arab project based on correlation between the democratic structure and the Arab identity as well as to reject the foreign domination in order not for the region to live under the international and regional polarizations again. All the Arabs want a joint media ashamed of distributing them by their community , their doctrines or their religious creeds that they belong to. We want a strong awareness that Israel doesn't stand as an observer to any Arab or national unity.

Lessons to be learned on the national level:

On one hand, the revision in our internal policies leads to foster a sense of good citizenship and assimilate the concept of national security, and every member of the members of the nation is considered to be an honest guardian (not to say luxurious but not hungry).

The presence of the elected councils that carry on their responsibility of planning for the country and to be the link between the people and power.

If injustice is evenly distributed, it is considered to be justice. In addition to that, the social justice and the fight against corruption are considered as the important pillars to establish rules of integrity and virtue.

Conclusion;

The change movements can now be distributed into three groups. The first one is considered to be delightful such as Tunisia and Egypt and some of them as disturbing such as Yemen ,Libya and Syria and most recently was sad such as Bahrain where the matter turned out to be based on a sectarian rankings.

There is no doubt that the popular movement and all what it can follow was and will be within endemic Arab societies with the diseases of tribal, sectarian and ethnic backwardness as well as the domination projects of discord, division and internationalization.

The successive governments are undoubtedly responsible for what we witness now , however this will not prevent the Arab peoples and the opposition to take their role in preserving/maintaining the limbs of one nation and the unity of all nations as a whole. Yes, now the people and the opposition are a strong party and has his own word.

The consideration into each one of these things is not enough to build a political and democratic regime , because any violent pressure for change in the community will be turned to be as a mean to blow social security and it will be difficult to be controlled.

In short, from the looks of the events happened today one can stand between two choices ; either the priority for selecting the governments between (the ruler and th chaos) and the priority for selecting the opposition (either democracy or division).

The reaping of revolutions' benefits lies in the fact through keeping them away from the hands of the hunters and trapping as what have been done to previous revolutions where they were a fertile field for the foreign intervention from powers that has been colonial in its essence

 and are still the same . It is time for peoples to wake up of their deep sleep and reach their senses. We are in need of popular movements whose aim is to gather and not to differentiate within the same country and among all the sons of the nation.

Electronic References:

Kifah Mahmoud. The Civilized dialogue. Number 2526. 14/1/2009 .

http:// www.ahewar.org

Nabil Al-Kassab, The Fate of the Arab Regimes 23/10/2011

http:// www.kitabat.inf

Dr. Shaker al-Nabulsi, Different Diseases have hampered the Arab Street from the performance of his role, number 5883, 12/10/2011

http:// www.al-watan.com

Dr. Sobhi Ghandoor, Arab vision for Arab variables , Publications of the Arab Dialogue Center, Washington, Fall 2001

 http:// www.alhewar.com

Egypt's 2011 Uprising is a Cautionary Tale for Ukraine

by Steven A. Cook February 28, 2014

Egypt's Muslim Brotherhood

by Zachary Laub January 1

Intervention In Syria: The View From Pyongyang

September 9, 20135, 2014

The Arab Spring: A Conversation with Alain Juppe

with Alain Juppe, James P. Rubin September 19, 2011

Islamist Extremism After the Arab Spring

by Jonathan Masters, Ali Soufan September 14, 2012

The Arab Spring Has Given Way to a Long, Hot Summer

by Richard N. Haass July 6, 2011

In the Arab Spring's Aftermath, Democracy Retreats

by Joshua Kurlantzick January 19, 2012

New Statesman: How the Economic Policies of a Corrupt Elite Caused the Arab Spring

by Matthew Partridge June 7, 2011

The Atlantic: The Modern King in the Arab Spring

by Jeffrey Goldberg March 18, 2013

New Era. By Lin Noueihed and Alex Warren. *Yale University Press; 350 pages; $28 and £18.99.* Buy from Amazon.com, Amazon.co.uk

The Rise and Fall of Arab Presidents for Life. By Roger Owen. *Harvard University Press; 248 pages; $24.95 and £18.95.* Buy from Amazon.com, Amazon.co.uk

The Syrian Rebellion. By Fouad Ajami. *Hoover Institution Press; 240 pages; $19.95 and £14.95 .* Buy from Amazon.com, Amazon.co.uk

Revolt in Syria: Eye-Witness to the Uprising. By Stephen Starr. *Columbia University Press; 226 pages; $20. Hurst; £14.99* Buy from Amazon.com, Amazon.co.uk

Definition of the Arab Spring - Middle East Issues - About.com

The Arab Spring was a series of anti-government protests, uprisings and armed rebellions that spread across the Middle East in early 2011. But their purpose ...

http://middleeast.about.com/od/humanrightsdemocracy/a/Definition-Of-The-Arab-Spring.htm

Arab Spring Uprisings - Middle East Issues - About.com

The Arab Spring was a series of protests and uprisings in the Middle East that began with unrest in Tunisia in late 2010. The Arab Spring has brought down ...

http://middleeast.about.com/od/humanrightsdemocracy/tp/Arab-Spring-Uprisings.htm

Arab Spring Impact on the Middle East

How did the Arab Spring uprisings of 2011 change the Middle East? Explosion of political activity and people power, but also political tension, economic ...

http://middleeast.about.com/od/humanrightsdemocracy/tp/Arab-Spring-Impact-On-The-Middle-East.htm

Islamists and the Arab Spring Uprisings

The Arab Spring uprisings in 2011 unleashed great political change in the Middle East. Did Islamist groups participate in the protests? How did they get involved ...

http://middleeast.about.com/od/religionsectarianism/a/Islamists-And-The-Arab-Spring-Uprisings.htm

The Arab-Israeli conflict from its origins to the present.

What have the Arab-Israeli wars got to do with the Palestinian question? How have the Palestinian uprisings precipitated or ambushed the peace process, and ...

http://middleeast.about.com/od/arabisraeliconflict/

Arab Spring - Results of the Arab Spring - An Arab Spring Postmortem

Protests against the government of longtime President Zine El Abidine Ben Ali, who took office in a 1987 coup, sparked the Arab Spring with the act of one street ...

http://worldnews.about.com/od/middleeas1/tp/Results-Of-The-Arab-Spring.htm

How Arab Spring Started

The Arab Spring was a series of anti-government uprising that shook the Middle East in 2011. Read about the first protests and how they grew into a mass ...

http://middleeast.about.com/od/tunisia/tp/How-The-Arab-Spring-Started.htm

After the Arab Spring - Transition in the Middle East - World News

Protests against the government of longtime President Zine El Abidine Ben Ali, who took office in a 1987 coup, sparked the Arab Spring with the act of one street ...

http://worldnews.about.com/od/middleeas1/tp/After-The-Arab-Spring.htm

Spanish Words Derived from Arabic - Spanish Language - About.com

Thousands of Spanish words come from the Arabic language. Here is a list of the most common.

http://spanish.about.com/cs/historyofspanish/a/arabicwords.htm

The Reasons for the Arab Spring in 2011 - Middle East Issues

What were the reasons for the Arab Spring in 2011? Read about the top ten developments that both triggered the revolt and helped it confront the might of the ...

http://middleeast.about.com/od/humanrightsdemocracy/tp/The-Reasons-For-The-Arab-Spring.htm

The effects of a rising population of killer whales (Orcinus orca) in the Arctic

Jessica Knoth

University of Washington

jessicaknoth@hotmail.com

Global climate warming is affecting the Arctic faster than anyone has predicted. Not only are the warming waters causing delayed freeze-up and accelerated break-up of sea ice, the increasing range of open water is encouraging more southern species to move north. One such species is the killer whale (*Orcinus orca*). The Arctic ecosystem is a fragile food web in that the organisms are mainly large and slow-reproducers, and there are few links in the chain between primary production and apex predators. The introduction of another top predator such as the killer whale could have highly detrimental effects to the ecosystem. This paper will analyze scientific literature about the phenomenon of killer whales colonizing the Arctic, and specifically what effects this will have on the Arctic marine ecosystem. Killer whale background, as well as sea-ice loss trends will be referenced, followed by discussion of increased sightings of killer whales in the Arctic, their ecotypes/hunting techniques, prey reactions to this new predator, and effects on the Inuit subsistence community.

Killer whale, arctic, orca, inuit, climate change, ecosystem, sea ice, polar bears

Introduction

Climate change is resulting in the Arctic sea ice freezing-up later in the season and melting sooner. Increasing amounts of open water are encouraging more southern species, such as killer whales, to migrate north. Killer whales (*Orcinus orca*) are the only cetaceans found in all of the oceans of the world, and their numbers are recently rising in the Arctic Ocean. They have complex social orders and cooperate together when hunting, which led to the Inuit nicknaming them "wolves of the sea" (Ferguson et al. 2012). They are the largest apex predators in the ocean, and it is has been suggested that they can reshape marine ecosystems via top-down forcing (Estes et al. 2009). This is a concern for the Arctic marine ecosystem because it has few links and is slow to adapt to change. With the killer whale population rising in the thawing north, scientists are trying to predict what will happen to the local populations of marine mammals. Narwhal (*Monodon monoceros*), beluga whales (*Delphinapterus leucas*), bowhead whales (*Balaena mysticetus*), and ringed seals (*Pusa hispida*) are all subject to preying upon by killer whales, and the dwindling number of polar bears (*Ursus maritimus*) may have to compete with this new top predator for food.

Polar bears are not the only hunters that may have to compete with killer whales, however. For hundreds of years, the Inuit have depended on whales as their primary food source. It still is not clear whether the killer whales will damage prey populations enough to make subsistence hunting unsustainable, but it is a possibility. Conversely, the Inuit hunters can often salvage "mattak" (whale skin and blubber) from the remains of killer whale feeds, so the relationship may not end up negative (Freeman et al. 2010).

This paper will analyze scientific literature about the phenomenon of killer whales colonizing the Arctic, and specifically what effects this will have on the Arctic marine ecosystem. Killer whale background, as well as sea-ice loss trends will be referenced, followed by discussion of increased sightings of killer whales in the Arctic, their ecotypes/hunting techniques, prey reactions to this new predator, and effects on the Inuit subsistence community.

Killer Whale Background

Killer whales are part of the Odontocete family, or toothed whales (NOAA-NMFS 2008). They are the largest species of dolphin, and are the top predators of the ocean. They live in matriarchal societies called pods; males are believed to stay with their mothers for their whole lives, often babysitting their younger siblings. There are believed to be two types of orcas; ones that prey on mammals, and ones that consume fish (Higdon 2007). Some of the most well-studied pods in the world are the whales in the Pacific Northwest. J, K, and L pods are the fish-eating ecotype, and are known as "resident" pods. The mammal eaters live in small, variable groups of 1-7 individuals, and travel great distances for food. These killer whales are known as "transients" in the Pacific Northwest (NOAA-NMFS 2008), and are believed to be the main ecotype in the Arctic, although fish and shark-eating types also live in the area. Their hunting strategies are complex and cooperative (Ferguson et al. 2012), and they adapt their techniques to different prey. Killer whales have been described as "intelligent social animals that transmit cultural heritages within stable family groups;" which makes sense, considering their brains are four times larger than humans, as well as relatively larger when compared to body size (Ferguson et al. 2012). Intelligence, strong family bonds, hunting cooperation, and the ability to adapt make killer whales formidable predators.

Changing Sea Ice Conditions in the Arctic

It is a well-known fact that the global climate is becoming warmer. In the past twenty years the extent of sea ice in the Arctic has declined at a rate of about 3% a year (Hoover 2010). Hudson Bay acts as a poster child for this change. The average annual temperature in Hudson Bay has increased at a rate nearly double that of temperature increases in the rest of the world; it is predicted to increase 4-7 degrees Celsius in the next one hundred years (Hoover 2010).The annual sea ice cycle in Hudson Bay begins with freeze up by mid December. The ice is thickest from April to May,

and begins to break up in June (Hoover et al. 2010). However, the warming trend has caused a later freeze up in Hudson Bay by 5.4 days a decade, as well as an ice decline of 10.1% - 10.7% from 1997-2007 (Hochheim et al. 2010). Unfortunately, less ice means more solar radiation is absorbed into the ocean because sea ice reflects radiation back into the atmosphere. This reduction in ice-albedo creates a positive feedback in the ecosystem, and ultimately, later freeze-up (Hoover 2010). Arctic seas are predicted to be seasonally ice-free within a few decades (Vincent et al. 2011).

Disappearing ice causes a number of problems in the Arctic marine ecosystem. Ice algae sustains the upper pelagic food web, which in turn provides nutrition for seals and polar bears (Hoover 2010). With sea ice melting, the ecosystem may switch from ice-dominated with bottom feeding birds and mammals that depend on carbon input from ice algae, to an open water system more dominated by plankton and pelagic fish (Vincent et al. 2011). However, this is just one issue. Mammals such as polar bears and ringed seals are not just ice-associated; they depend on it. Ringed seals need sea ice to haul out on and to molt, as well as ice ridges for dens to raise their pups in. (Chambellant et al. 2010). Similarly, polar bears depend on annual sea ice to rest on when swimming, and as platforms to hunt for ringed seals. Some polar bear populations are declining because bears are drowning when trying to find the ice edge. Even if they do reach the edge, there may not be any prey for them to hunt. Females are too lean to provide milk for both cubs, and consequently, one or both of the offspring die. To make matters worse, hungry males will cannibalize young bears, further contributing to the declining population growth (Peacock et al. 2010).

Arctic mammals tend to be large, specially adapted to their environment, and have slow reproductive rates. These traits make it difficult for them to recover from severe changes in their habitat, especially if they occur at a rapid rate, as global warming is (Peacock et al. 2010). When combined with the invasion of southern species that can take advantage of the more temperate environment, their chances of survival are even lower. Killer whales are one of the southern species that will drastically affect the Arctic ecosystem. Less ice formation, along with the melting of ice blockages, make it possible for them to move into previously inaccessible areas (Hochheim et al. 2010). Hudson Straight was once a significant sea ice choke point. It opened up approximately fifty years ago, and resulted in the initial appearance of killer whales in the Hudson Bay region (Higdon and Ferguson 2009).

Increased Sightings of Killer Whales

Killer whales were historically present in the Davis Strait and Baffin Bay region, with records going back to the 1880s from bowhead whaling log books (Higdon 2007). They have only recently arrived in the Hudson Bay area. Inuit hunters in the Canadian eastern Arctic have reported a recent increase in killer whale sightings, suggesting that the whales are extending their range into the eastern Arctic as climate warming occurs. The majority of the sightings occur in summer (June-September) when the waters are mainly ice free (Higdon 2007). Satellite tracking shows that seasonal patterns in killer whale occurrence in the eastern Canadian Arctic.Their numbers increase gradually through spring (June to July), peak in summer (August), and decline through early fall (September to October) (Matthews et al. 2011). During the late summer months, killer whales enter bays and inlets in the Canadian Arctic in pursuit of prey such as narwhal, beluga, and bowhead whales. They are thought to seasonally migrate to overcome limitations imposed by pack ice (Matthews et al. 2011). This is interesting because killer whales in the Antarctic have been seen using leads and polynas to disperse deep within the sea ice, and also within ice fields of the northwest Atlantic (Matthews et al. 2011). It is feasible that they will eventually adapt and do the same in the Arctic ice.

Increased sightings could be due to change in killer whale distributions, population increases, or increased sighting efforts (Higdon 2007). Whatever the case, killer whales went from not living in

Hudson Bay at all prior to the 1900's, to now showing up annually. If future predictions from climate-sea ice models are correct, more killer whale sightings will occur in the Hudson Bay region, as well as farther into the Canadian Arctic Archipelago (Higdon 2007). The current marine mammal ecosystem in the Hudson Bay region is ice-adapted with polar bear-seal as the main trophic relationship. As sea ice declines further, however, polar bears may be replaced by killer whales as the dominant marine mammal predator, and predation on belugas/narwhal will increase significantly (Higdon 2007).

Ecotypes

As mentioned before, there are two types of killer whales; those that eat fish, and those that eat mammals. However, these groups can be broken down into different ecotypes. The southern resident pods are the fish-eating ecotype and 99% of their diet is chinook salmon (*Oncorhynchus tshawytscha*). The transient pods are mammal-eating, and consume largely harbor seals (*Phoca vitulina*) and dall's porpoise (*Phocoenoides dalli*). The "offshore" ecotype consumes larger fish and sharks (NOAA-NMFS 2008). There are three distinct ecotypes in Antarctica - A, B, and C. They feed on Antarctic minke whales (*Balaenoptera bonaerensis*), seals, and fish, respectively (Pitman et al. 2011). There have only been 22 individual killer whales identified in the Arctic so far, and it is not entirely clear what they eat. Inuit and scientific observations indicate only mammals, however analyses of stomach contents in the past contained fish as well (Higdon 2007). However, for our purposes, we will identify them as transients, because they seem to be most similar to that ecotype.

Killer whales are generalist feeders in that they *can* eat anything, however, they choose to only eat specific prey. If food is abundant, they often only eat select pieces of that prey (Pitman et al. 2011). The population of killer whales in the eastern Canadian Arctic prey on monodontids (narwhal and beluga) most often, followed by bowhead whales, and phocid seals. In terms of diet biomass, bowhead whales provide over 50%, seals provide about 3%, and monodontids provide about 40%, with belugas contributing 36% of the 40% (Ferguson et al. 2012). Killer whales can almost be described as picky eaters. They will often consume only the tongue and lips of bowhead whales, and only the meat of seals (Ferguson et al. 2010). Not only do they only consume "choice" parts of prey when food is abundant, they may not eat their quarry at all. It was found that killer whales only eat 80% of the monodontids they kill, and only 90% of seals (Ferguson et al. 2010). No one knows why they would waste a kill, but it has been suggested that this habit of "killing for fun," or "playing" with wildlife, as the Inuit have called the behavior, could be a way of teaching juveniles to hunt (Ferguson et al. 2012).

Hunting Techniques

Resident orcas forage individually for fish, but mammal-eating transients use cooperative hunting techniques to work together in small groups for the same prey item. To understand the complexities of their teamwork, pods versus groups must first be defined. A pod is a set of individuals that associate with one another at least 50% of the time, while a group is a bunch of individuals (possibly multiple pods) acting together in a coordinated manner (Higdon 2007). Transient pods are usually just one matriline consisting of about 4 individuals. The largest group observed in the Canadian Arctic was 22 whales, and the average group size was 10 (Higdon 2007). A group of killer whales will work together to find and kill prey, and then will share it not only with each other, but with other hunting groups. The other groups will return the favor later (Pitman et al. 2011).

Strategies of Hunting Monodontids

Killer whales alter their hunting techniques depending on their prey. The strategies they use to kill narwhal will be talked about, however, belugas are hunted in the same way. A group of killer whales will begin by stalking their prey - in this case, narwhal. They will slow down once in the

vicinity of the narwhal, and move deliberately to reduce the wake and sound produced by their dorsal fins moving through water (Ferguson et al. 2012). Once close enough they will speed up and herd the narwhal into deep water. If the narwhal happen to escape to shallower waters, smaller whales will go and grab the narwhal, and then head back out to the deeper water where the large whales stayed. The whales will circle the narwhal to keep it stationary, and tire it out before they start to attack (Ferguson et al. 2012). The killer whales will then proceed to ram the narwhal to do internal damage and break its ribs, play with it (or pieces of it) and toss it around, and sometimes one will carry it in its mouth after biting the narwhal in the middle. The killer whales may kill the narwhal in a variety of ways, including holding it underwater until it drowns, slapping it with a tail, or biting the narwhal and pulling it apart - leaving the head and tail behind and taking the "meat in the middle" (Ferguson et al. 2012).

It has been observed that killer whales are cautious predators. Despite their size and strength, they are careful to avoid the sharp teeth and dangerous tails of their prey (Pitman et al. 2011). Killer whales in the Antarctic, for example, are very aware of weddell seals' (*Leptonychotes weddellii*) snapping jaws, even though a whale could dispatch a seal in one bite. They do not like to receive any sort of injuries (Pitman et al. 2011). For this reason, killer whales rarely attack male narwhals. The male narwhals have tusks that can impale the killer whale, usually resulting in the death of both whales (Ferguson et al. 2012).

Killer whales typically only eat the meat of narwhal and belugas. Consequently, attacks are often accompanied by oil slicks and scraps of blubber/skin (Ferguson et al. 2012). Because these predation events happen underwater, it can be hard for an observer to know what is happening. This is partially why scientists do not know if the killer whales in the eastern Canadian Arctic eat fish along with mammals - it's nearly impossible to observe (Higdon 2007). The appearance of oil slicks and pieces of blubber are the most direct way to know if an attack on a monodontid happened. The Inuit will often collect these pieces of "mattak;" large aggregations of sea birds feed on them as well (Ferguson 2012). It is estimated that there is a mortality rate of about 200-300 narwhal a year by killer whales (Laidre et al. 2006), and 174 beluga (Ferguson et al. 2012).

Strategies of Hunting Bowhead Whales

Bowheads are baleen whales that grow to be about 14 meters long and 100 tons (George et al.1994). Killer whales reach around 9 meters long and weigh about 9000 kg - just short of a ton (Higdon 2007). Yet, despite the size difference they can hunt the much larger whales because they work in groups. The massive size of adult bowheads is probably the reason killer whales mainly hunt juveniles, but they have been observed killing adults (Ferguson et al. 2012). Hunting such large prey can result in fatal injuries to killer whales. One smack with a bowhead's fluke could take out the smaller whale (Ferguson et al. 2012). Hence, killer whales are careful to immobilize the bowhead they are attacking. Some of the whales will bite and hold on to the front flippers and tail of the bowhead, while others circle to keep it from escaping. The killer whales will ram the bowhead to cause internal damage and tear chunks out of it. The eventual goal is to either roll the bowhead over so that it's blowhole is covered, or to drag it underwater until it drowns (Ferguson et al. 2012). After killing the bowhead, the killer whales may only eat the lips and tongue of it. They do not eat the majority of the whale (Ferguson et al. 2012). Inuit hunters estimate that killer whales kill around 57 bowhead a year (Ferguson et al. 2012).

Strategies of Hunting Seals

Seals are smaller than monodontids and bowhead whales, but are still commonly hunted by killer whales. Ringed seals are the preferred prey, most likely because they are the smallest and most docile of the seal species found in the Arctic (Ferguson et al. 2010). The whales either kill the seals by slapping them into the air with their tails, or by drowning them after washing them off of ice floes. "Wave-washing" is a hunting technique also used by the Antarctic seal-eating whales (Pitman

et al. 2011). Killer whales first locate seals by spy-hopping (lifting their heads vertically out of the water to view things above the surface), and then create a wave to wash the seal off of the ice floe (Pitman et al. 2011). Wave-washing behavior will be broken down for an accurate visual.

Sea-ice floes are from 1-3 meters tall and flat; glacial ice is taller and oddly shaped. Seals are more commonly found on lower sea ice, but have less chance of being seen or washed off of glacial ice (Pitman et al. 2011). Killer whales begin the hunt by individually spy-hopping among the ice floes. Once a suitable individual has been located, the whole group spy-hops around the floe with the seal. They then stop spy-hopping, and swim together in loose rank formation while rolling over at the surface. After a couple of false starts they swim off side-by-side at the surface until they reach a distance about 50 meters away. They turn abruptly back to the floe and charge underwater - their bodies parallel and almost touching, flukes beating rapidly and synchronously (Pitman et al. 2011). A small wave forms in front of their heads, with a trough over their body and a large wave behind their tails. Just before they hit the ice they dive underneath and turn on their sides so that their dorsal fins don't hit the ice (Pitman et al. 2011). For small floes, the wave is enough to wash the seal off; for big floes, they continue pumping their tails underneath the ice, which shatters into pieces. Wave-washing almost always works, but if it fails the killer whales can work together to lift the ice with their heads and flip it over (Pitman et al. 2011).

All of this effort was simply to wash the seal off of the ice floe. The whales now have to exhaust the seal enough that they can bite it by the flippers and drag it underwater to drown, all the while avoiding its claws and teeth. There are usually multiple points in the hunt where the killer whale could easily bite the seal in half, however, they resist damaging the animal in any way. It has been suggested that the less damage there is to the seal, the easier it is for the whales to "butcher" it underwater (Pitman et al. 2011). Seal remains have been found where the animals have literally been skinned. The whales neatly slice the skin at the base of the neck, and then peel back the blubber until they can pull the meat of the seal out in one piece. Just like they do with narwhal, belugas, and bowheads, the killer whales eat only choice portions of the animal; leaving the blubber and skin behind. After killing the seal, most of the group moves on to look for more seals. The catch is shared not only within the group, but with other groups as well, who will share the results of their hunt later.

Prey Animal Reactions to Killer Whales

In general, marine mammals are frightened of killer whales and behave defensively when they are nearby, even if the whales aren't hunting, or are the fish-eating ecotype (Ferguson et al. 2012). However, killer whales are intelligent, social animals, that, despite their hunting prowess, attract the curiosity of other mammals. Several species of dolphins interact with killer whales in non-predatory contexts. These include close proximity of both species with no response by either, simultaneous feeding in close proximity, avoidance or flight from killer whales (despite no attack from the whales), and apparent attraction to the killer whales (Jefferson et al. 1991). The "curiosity" phenomenon includes humpback whale (*Megaptera novaeangliae*) interference on killer whale hunts resulting in the seal escaping, and dall's porpoises approaching the whales to play (Jefferson et al. 1991). Both humpbacks and dall's porpoises are species that are preyed upon by killer whales, making these interactions risky. Killer whales have been documented harassing humpback whales with no obvious intention of hunting them; usually until the humpback tail-slaps vigorously and trumpets loudly (Pitman et al. 2011). This behavior is not entirely innocent, however, it is thought that "harassment" may actually represent attempts by the predators to check for young or weakened animals. In any case, humpbacks occasionally interfere in killer whale hunts or harass the predators for no apparent reason (Jefferson et al. 1991). These are examples of interactions that don't result in the death of the prey animal, however, most killer whale interactions with other marine mammals are predatory.

Monodontid Reactions to Killer Whale Predation

The Inuit have observed the rise of killer whales in the Arctic, and with it, have seen behavioral changes in the local marine mammals. They have a word, "aarlirijuk," that means "fear of killer whales," and describes the fleeing of narwhal, belugas, and bowheads into shallow water to escape the predators (George et al. 1994; Ferguson et al. 2012). A team of researchers observed the behavior of narwhals in the eastern Canadian Arctic prior to an attack by killer whales, during the attack, and immediately after the attack. 5+ days prior to the narwhal noticing the killer whales in the area, they moved in groups of 3-8 approximately 20-200 meters from the beach, headed south (Laidre et al. 2006). As soon as the narwhal sensed the killer whales were in their immediate vicinity, they moved closer to shore (about 2 -3 meters from land). They remained still at the surface in large groups, and moved slowly to avoid detection (Laidre et al. 2006). Once the killer whales moved in to attack, the narwhal made tail slaps, stranded themselves attempting to escape in shallow water, and dispersed in all directions - doubling their home range (Laidre et al. 2006). The narwhal resumed their normal swimming behavior and distance from the coast within an hour after the killer whales left, however they remained more widely spread out, and ranged further than before the attack (Laidre et al. 2006).

Despite a mortality rate of 200-300 narwhal that represents <3% of their abundance estimate, killer whale predation is not thought to significantly depress narwhal populations (Laidre et al. 2006). Narwhal do not change their summering grounds or depart early in response to killer whale presence, even on longer scales of around 2 months (Laidre et al. 2006). Killer whale predation alone may not force a decline in narwhal population, but predation combined with subsistence hunting could lower their numbers. On the other hand, less sea ice means less ice entrapment of narwhal (a major cause of mortality), which may balance out the additional predation by killer whales (Laidre et al. 2006). Beluga whales behave similarly to narwhal in that they escape to shallow waters, and stop vocalizing when killer whales are in the vicinity (Ferguson et al. 2010).

Bowhead Whale Reactions to Killer Whale Predation

Killer whales and bowhead in the Bering Sea overlap ranges during fall (George et al. 1994). 14.9% to 19.1% of mature bowheads carry scars on their flippers and flukes from killer whales trying to immobilize and drown them. (George et al. 1994). Not only do bowheads stop vocalizing and swim in shallow waters when killer whales are near, they also travel north through Fury and Hecla Strait as sea ice breaks up to avoid predation (Higdon and Ferguson 2009). Despite bowhead avoidance behaviors, killer whales may be partly responsible for the failure of bowheads to recover from commercial whaling in the eastern Arctic (George et al. 1994).

Ringed Seal Reactions to Killer Whale Predation

Ringed seals do not have much in the way of defenses that can protect them from killer whales. Instead, seals haul out on land when whales are in the area, which they do not normally do (Ferguson et al. 2012). Habitat loss in Hudson Bay has led to a long-term decline of ringed seals (Chambellant 2010). Considering they are the primary prey of polar bears (Peacock et al. 2010), extra killer whale predation upon ringed seals will not help the Hudson Bay population recover (Chambellant 2010).

Inuit Interactions with Killer Whales

The Inuit people have lived in the Arctic for hundreds of years. They know how the ecosystem works, and have observed changes with the reduction of sea ice (Freeman et al. 1998). Because of this, traditional ecological knowledge (TEK) has been used to better understand narwhal and beluga communities, and on killer whale predation in the Arctic (Ferguson et al. 2012).

The Inuit have hunted whales and other marine mammals for food for centuries (Freeman et al. 1998). They depend on not only the meat of the animals for survival, but their "mattak" as well.

Mattak is made up of blubber and skin, and in a harsh environment that doesn't support crops, is the only provider of vitamins C, A, thiamin, riboflavin, and niacin to protect against scurvy (Freeman et al. 1998). The Inuit have always hunted marine mammals sustainably, that is, they don't cause a harmful depression in the populations of narwhal, beluga, bowheads, and seals (Freeman et al. 1998). However, there are concerns on whether both the killer whales and Inuit can hunt local stocks of marine mammals without damaging their population growth (Ferguson 2012).

Hunting cetaceans not only provides food for the Inuit, it reinforces traditional social order. The oldest and most experienced hunters assume roles as leaders and decision makers for the group (Freeman et al. 1998). In addition, the whole community gets involved in the hunt and shares the bounty (Freeman et al. 1998). The Inuit don't waste any of the animal they've harvested; they consume the meat and blubber, and use the other parts to make tools (Freeman et al. 1998). Because of this, some interviewed Inuit hunters feel negatively toward killer whale wasting of food. Others think it is positive because they get to gather the rejected mattak (Ferguson et al. 2012). This is not the first time killer whales and humans have shared their catch. In Twofold Bay, New South Wales, Australia, humans and killer whales cooperated for 80 years (Jefferson et al. 1991). A group of 30 killer whales hunted local humpback and right whales, and would sometimes actively attract the attention of shore lookouts when the baleen whale was detected. After the kill, which involved both human and whale actions, the whalers would allow the predators to eat the tongue and lips of the sinking baleen whale (Jefferson et al. 1991). The next day the whalers would return to the re-floated carcass and retrieve the meat and blubber. Eventually the whales died out or moved elsewhere, and the technique became less profitable for the whalers (Jefferson et al. 1991).

Not all interactions are mutually beneficial between the Inuit and killer whales. The largest source of killer whale mortality in the Arctic is direct human killing by the Greenland Inuit (Higdon 2007). Killer whales are sometimes caught in ice-entrapments, and are then harvested by Inuit. Only 21 known whales have been harvested in the eastern Canadian Arctic since the 1950s, however the actual population growth of killer whales is unknown, and harvesting by the Inuit may be unsustainable (Higdon 2007).

Conclusion

The Arctic ecosystem is changing. Global climate change is warming the Arctic Ocean, and causing sea ice to form later and melt sooner. Arctic seas will be seasonally ice-free within a few decades (Vincent et al. 2011). The slightly more temperate water is encouraging southern species to migrate north. One such species is the killer whale (Vincent et al. 2011). Killer whales in the Arctic are mammal eating, and prey on narwhal, belugas, bowheads, and seals. They have a variety of hunting strategies that all involve cooperation between groups (Ferguson et al. 2012). Killer whale predation, combined with Inuit subsistence hunting may cause depressions in prey populations (Ferguson et al. 2012). There are only 22 identified individual killer whales in the Arctic, it is not known how their population is growing, or how they will affect the Arctic ecosystem in the long run (Hoover 2010).

References

Chambellant M, (2010) Hudson Bay ringed seal: ecology in a warming climate. A Little Less Arctic 137-158.

Estes JA, (2009) The Aleutian Archipelago; addressing the functional importance of carnivory through variation in space and time. The Ecology of Place: Contributions of Place-Based Research to Ecological Understanding 154-176.

Ferguson SH, Higdon JW, Chmelnitsky EG, (2010) The rise of killer whales as a major Arctic predator. A Little Less Arctic 117-136.

Ferguson SH, Kingsley MCS, Higdon JW, (2012) Killer whale (*Orcinus orca*) predation in a multi-prey system. Population Ecology 54:31-41.

Ferguson SH, Higdon JW, Westdal KH, (2012) Prey items and predation behavior of killer whales (*Orcinus orca*) in Nunavut, Canada based on Inuit hunter interviews. Aquatic Biosystems 8:1-16.

Freeman MMR, Bogoslovsk L, Caulfield RA, Egede I, Krupnik I, Stevenson MG, (1998) Inuit, Whaling, and Sustainability. Walnut Creek, CA, USA.

George JC, Philo LM, Hazard K, Withrow D, Carroll G, Suydam R, (1994) Frequency of killer whale (*Orcinus orca*) attacks and ship collisions based on scarring on bowhead whales (*Balaena mysticetus*) of the Bering-Chukchi-Beaufort Seas stock. Arctic 47:247-255.

Higdon J, (2007) Status of knowledge on killer whales (*Orcinus orca*) in the Canadian Arctic. Ecological Applications:3-41.

Higdon JW, Ferguson SH, (2009) Loss of Arctic sea ice causing punctuated change in sightings of killer whales (*Orcinus orca*) over the past century. Ecological Applications 19:1365-1375.

Hochheim K, Barber DG, Lukovich JV, (2010) Changing sea ice conditions in Hudson Bay, 1980-2005. A Little Less Arctic 39-52.

Hoover C, (2010) Hudson Bay ecosystem: past, present, and future. A Little Less Arctic 217-236.

Jefferson TA, Stacey PJ, Baird RW, (1991) A review of killer whale interactions with other marine mammals: predation to co-existence. Mammal Rev. 21:151-180.

Laidre KL, Heide-Jorgensen MP, Orr JR, (2006) Reactions of narwhals, *Monodon monoceros*, to killer whale, *Orcinus orca*, attacks in the eastern canadian Arctic. Canadian Field Naturalist 120:457-465.

Matthews CJD, Luque SP, Andrews RD, Ferguson SH, (2011) Satellite tracking of a killer whale (*Orcinus orca*) in the eastern Canadian Arctic documents ice avoidance and rapid, long-distance movement into the North Atlantic. Polar Biology DOI 10.1007/s00300-010-0958-x.

NOAA-NMFS (2008) Recovery Plan for Southern Resident Killer Whales (Orcinus orca)

Peacock E, Derocher AE, Lunn NJ, Obbard ME (2010) Polar bear ecology and management in Hudson Bay in the face of climate change. A Little Less Arctic 93-116.

Pitman RL, Durban JW, (2011) Cooperative hunting behavior, prey selectivity and prey handling by pack ice killer whales (*Orcinus orca*), in Antarctic Peninsula waters. Marine Mammal Science 28:16-36.

Vincent WF, Callaghan TV, Dahl-Jensen D, Johansson M, Kovacs KM, Michel C, Prowse T, Reist JD, Sharp M, (2011) Ecological implications of changes in the Arctic cryosphere. AMBIO 40:87-99.