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CONTENTS

Histomorphological Study of Dentine Pulp Complex of Continuously Growing Teeth in the Rabbits

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Abstract: Background: Rabbits have a diphyodont dentition (permanent and deciduous sets of teeth). Rabbit teeth are also heterodont (of different types)**.** Incisors as well as posterior cheek teeth are *aradicular hypsodont*, indicating that the teeth have a long anatomic crown and do not have true roots. These teeth erupt continuously, and remain open-rooted. **Aim:** The present study aims to clarify the morphological and histological features of the dentine pulp complex of continuously growing incisors & molars teeth of rabbits. **Methods:** Ten male New Zealand white rabbits in the age of three months old were used in this study. After scarification, the lower jaws were dissected out and hemisected in sagittal direction into two halves (right and left sides of the mandible), Then prepared for Morphological examination using sterio microscopy and histological examination of decalcified and ground sections using light microscopy. **Results:** sterio microscopic examination revealed that molar teeth consist of two laminae with double apical openings. Histological examination for the rabbit teeth showed dentine precipitation along the side of the pulp and complete obliteration of the coronal portion of the pulp by osteodentine. **Conclusion:** different types of dentine are precipitated within the pulp chamber of continuously growing teeth as a compensatory mechanism for continuous teeth wear out. [Zoba H. Ali and Rabab Mubarak. **Histomorphological Study of Dentine Pulp Complex of Continuously Growing Teeth in the Rabbits.** *Life Sci J* 2012;9(3):1554-1564] (ISSN:1097-8135). http://www.lifesciencesite.com. 226

Keywords: rabbit cheek molar teeth; dentine pulp complex; osteodentine.

1. Introduction

Rabbits are small mammals fall into the order Lagomorpha (Lagomorpha means 'hare-shaped'), **family** *Leporidae* , and **genus & species** *Oryctolagus Cuniculus* [(1)]. There are many species of rabbits. Rabbits are herbivores (plant eating) and have a high reproduction rate. The teeth of the rabbit have some characteristic mammalian features; they are heterodont and diphylodont [(2)]. Rabbits have a diphyodont dentition (i.e. two successive dentition, deciduous and permanent dentition). They usually shed their deciduous teeth before (or very shortly after) their birth, and are usually born with their permanent teeth [(3)]. However, Navarro *et al.,* [(4)] reported that the eruption of deciduous molars of the mandible begins at four days after birth and of the mandibular permanent molars at nine days, while that of mandibular premolars occurs at twenty three days, replacing the mandibular deciduous molars which have exfoliated. At thirty two days all the mandibular permanent cheek-teeth are erupted. Moreover, at birth the mandibular deciduous molars are completely developed and at four days their root resorption is initiated.

The teeth of rabbits complement their diet, which consist of a wide range of vegetation. Since many of the foods are abrasive enough to cause attrition, rabbit teeth grow continuously throughout life. All permanent teeth in rabbits are elodont (i.e., continuously growing, "open-rooted") [(5)]. Elodont teeth never form anatomical roots, the exposed part of the tooth is referred to the "clinical crown" the embedded part being the "reserve crown", with a germinal, growing, region at the apex [(6)]. All teeth of the rabbit are aradicular hypsodont, which means that there is an anatomic long crown but no true root. The crown is divided into supra-gingival and sub-gingival parts. The latter part is also called the reserve crown [(7&8)]

The teeth of the rabbit are also heterodont. Heterodont teeth are simply teeth of different types as opposed to teeth of the same type, called homodont. Rabbits have incisor teeth and cheek teeth. The cheek teeth include both premolars and molars. Rabbits do not have canine teeth as in cats, dogs, ferrets and hedgehogs. The deciduous dentition (16) is as follows: maxillary: two incisors and three molars; mandibular: one incisor and two molars. The permanent teeth (28) are maxillary: two incisors, three premolars, and three molars; mandibular: one incisor, two premolars, and three molars. **Anatomic Dental Formula** 2(I 2/1 C0/0 M3/2) = 16 deciduous teeth and 2(I2/1 C0/0 P3/2 M3/3) = 28 permanent teeth. In the adult rabbit, upper two incisors are situated in each premaxilla; one is located behind the other. The posterior incisor is smaller than the anterior one. Its existence is a characteristic feature of the lagomorph family. There is only one incisor in the mandible [(2)]. Lagomorphs are distinguishable from rodents in that they have two pairs of upper incisors (the second pair, located immediately behind the larger incisors, are small and peg shaped, often referred to as the "peg teeth"); rodents have one pair [(9)].

Lagomorphs also have more teeth than rodents (especially, premolars). The incisors of both lagomorphs and rodents are "aradicular hypsodont"

therefore, they continually grow throughout life. Lagomorphs and the truly herbivorous rodents (such as the chinchilla and guinea pig) feed on tough, fibrous vegetation in their natural environment; other rodents, such as hamsters, rats, and mice feed mainly on tubers (a fleshy, underground part of a plant, such as a potato), seeds, and grain. In the true herbivores, the diet tends to have a low energy content requiring the intake of larger quantities of food, resulting in more grinding of the vegetation and rapid wear to the cheek teeth (large teeth in the back of the mouth used for grinding). As a result, the cheek teeth, like the incisors, have evolved to continuously grow throughout life. In other rodents, the diet of tubers, seeds, and grain requires little chewing, resulting in little wear of the cheek teeth. As a result, these cheek teeth have anatomical roots and stop growing once they have fully erupted [2&10].

Rabbits have a typical herbivore occlusion: The premolars and molars are grouped as a functional unit with a relatively horizontal occlusal surface with transverse enamel folds (i.e., lophodont type of teeth: lophos ridge) for shredding and grinding tough fibrous food. The occlusal surfaces of these teeth consisted of three tissues of different hardness (enamel, dentine and cementum) arranged in different layers. The premolar teeth are similar in form to the molar teeth, and are usually described together as the 'cheek teeth'. They are closely apposed and form a single functional occlusal grinding surface. The teeth of species with abrasive diets resulting in rapid tooth wear. The most extreme modifications of the teeth generally occur in herbivores. The cheek teeth, premolars and molars, are modified with multiple folds of tooth structure, forming ridge patterns that help in reduce the rate of tooth wear [11].

Some authors use the term *aradicular hypsodont*, indicating that the teeth have a long anatomic crown and do not have true roots. These teeth erupt continuously, and remain open-rooted [1]. Open rooted refers solely to the large apical opening present in all continuously growing teeth [12]. Three to four millimeters of tooth is worn away by incisors every week, whereas the posterior teeth require a month to wear away the same amount [13].

In the normal rabbit, the eruption and growth of the incisors continues at a rate of 2-3 mm a week. The incisor growth and wear are balanced [14]. Therefore the diet must contain abrasive particles to ensure this equilibrium between growths and wear [15]. Mandibular incisors and cheek teeth grow and erupt faster than maxillary teeth [16].

The dental pulp is a highly specialized mesenchymal tissue characterized by the presence of odontoblasts and it is surrounded by a rigid mineralized tissue. The primary function of the dental pulp is to form dentine. Other functions include the nutrition of dentine and the innervations and defense of the tooth [17]. The dental pulp is infiltrated by a network of blood vessels and nerve bundles emanating from the apical region [18]. Dentin presents a tubular structure that maintains it in an intimate relationship with the pulp tissue through the odontoblastic process [19].

A large amount of research into the mechanisms of tooth growth and eruption has been performed using elodont incisor teeth, principally in guinea pigs, rats and mice, but little has been done undertaken regarding continuously erupting teeth of the rabbit incisor, premolars and molars. The present study aims to clarify the morphological and histological features of the dentine pulp complex of continuously growing teeth of the rabbits.

2. Material and Methods:

Ten male New Zealand white rabbits in the age of three months old were used in this study. After sacrification, the lower jaws were dissected out and hemisected in sagittal direction into two halves (right and left sides of the mandible). Then they prepared for the following examinations:

1- Morphological examination:

Some of the right sides of the mandible were stored in buffered solution (4.6 formaldehyde solution). Each side was embedded in a quick setting transparent blocks (bioplast). The bioplast consisted of base, catalyst and accelerator which were mixed properly just before use, then poured in suitable rectangular plastic containers. Initial setting of the mix was reached after about 8 hours, while complete setting occurred after 24 hours. After complete setting the blocks were removed from the plastic container and cutting sagitally into two half in mesiodistal direction and parallel to the axial plane by using Bronwill sectioning machine having diamond disc under water spray. Each half was kept without polishing. The sectioned surfaces were examined and photographed using the Stereo microscopy (Leica S 8Apo) to reveal the morphological characteristics of rabbit incisor& molar teeth.

2- Histological examination using decalcified sections:

The left sides were fixed immediately in 10% calcium formol for 12 hours, then were decalcified with 10% ethylene diamine tetra-acetic acid (EDTA), pH. 7.3 for 4 weeks at 4˚C. After decalcification, the specimens were rinsed with buffer solution, dehydrated in ascending grades of ethyl alcohol, cleared in xylol and embedded in paraffin wax. Longitudinal sections of 6-7um were obtained and mounted on clean glass slides and stained with stained with Haematoxylin and Eosin stain for light microscopic examination.

3- Histological examination using ground sections:

Other right sides of the mandible were stored in buffered solution (4.6 formaldehyde solution). Each

side was embedded in a quick setting transparent blocks (bioplast) and cutting sagitally, mesiodistally in a plane parallel to the long axis of the mandible by using Bronwill sectioning machine having diamond disc under water spray. The obtained longitudinal ground sections were about 1mm thick. Further thinning was carried out by Carborundum abrasive paper with water proof adhesive grit no. 320& 400 which cut slower and more evenly. When the section began to get transparent and showed signs of bending its thickness was measured using special micrometer. Ground sections of about 100 um in thickness were mounted on clean glass slides. Transverse ground sections were also obtained in the same manner. All sections were examined under light microscopy.

3. Results:

Morphological results:

Stereo-microscopic examination of sagittal sections of rabbit mandible revealed presence of one incisor, two premolar and three molar teeth. Both premolars and molars are identical in shape and are aligned vertically. Third molars are usually curved distally. The apical parts of the lower teeth are divergent like a fan (Fig. 1). The cheek teeth (premolars & molars) in the mandible are located in its center, equidistant from the incisors and the condyle. All premolars and molars consist of two longitudinal parts called laminae with characteristic apical root opening so each tooth is characterized by presence of double root openings. The pulp cavity extends to about three quarters the length of the tooth. Each pulp chamber tapers towards the occlusal end and some long thin horns arise from the pulp and extend vertically towards the periphery of the tooth (Fig. 2). The conical-shaped, pulp cavity can be visualized as bounded above and lateral by dentine which, due to continued deposition, obliterates the pulp cavity near the occlusal surface. The pulpal slits (the sites of occlusion of the pulp cavities) can be traced from the tip of the pulp chamber to the occlusal surface. The coronal portion of the pulp appeared completely obliterated by calcifications while the apical portion of the pulp was opened with some internal calcifications. The occlusal surface of the cheek teeth appeared rough and uneven due to enamel crests and dentinal grooves (Figs. 3 & 4).

II- Histological results of decalcified sections:

Light microscopic examination of rabbit lower molar tooth at 3months old showing its histological structure consisting of two laminae aligned mesially and distally to each other. Each lamina is formed of dentine and encloses a separate pulp chamber but the two chambers merge near the apical or formative end and have double apical openings. The 2 laminae are separated by a large groove which is lined by enamel towered the mesial lamina and dentine towered the distal lamina and filled by cellular cementum. Many columnar-shaped ameloblasts were observed adjacent to the cellular cementum which deposited a large amount of enamel matrix (Fig. 5). Near the apical portion of the molar teeth revealed wide pulp cavity lined by odontoblastic layer, thin layer of predentine and covered by dentine and enamel. The pulp and apical soft tissue is highly vascular, thin vascular channels course in a longitudinal direction through the apical pulp tissue were detected (Fig. 6).

In the apical region the pulp is open, wide and represents the growing portion. Single pulp chamber was appeared at the tooth apex which diverges into two pulp chamber towards the mesial and distal laminae. The pulp was displayed a range of development from undifferentiated cells and no dentine through preodontoblasts forming mantle dentine to mature secretory odontoblasts producing tubular dentine. The cervical loop was composed of a core of stellate reticulum surrounded by inner and outer enamel epithelium and appeared at the periphery of the growing end. Moreover, in the area of the folds, the enamel organ was continuous between the laminae of the tooth. Interlaminar loop are formed between the two laminae and consisting of loosely aggregated stellate reticulum in the center surrounded by inner enamel epithelium and outer enamel epithelium. The continuously growing molar of the rabbit was appeared with complex structure (Figs.7&8). The apical end of these molars is the site of differentiation and the region where initiation of odontogenesis occurs. A row of columnar odontoblasts was seen along the periphery of the pulp bordering the dentine (Fig. 8).

Histological examination of the pulp at the middle portion revealed presence of numerous denticles along the side of the pulp and an area of pulpal cell proliferation was evident. The pulp chamber was characterized by presence of normal pulp tissue and lined by odontoblastic layer that covered by dentine and enamel on its external side. While the side that facing the groove between the two laminae was covered by dentine, enamel and cellular cementum. It was obvious that, enamel layer lining of the groove was extremely thinner than enamel layer covering the external tooth surface and covered by cellular cementum. The cementum covering the cheek teeth is largely cellular. It varies in thickness around the circumference and between the subunits of the cheek teeth (Fig 9).

Other specimens revealed fusion of the small denticles forming large denticles obliterating the middle portion. Higher magnification showed that, these large denticles contained little number of dentinal tubules (Fig 10). With the narrowing of the pulp chamber, the primary dentine increased in thickness. The odontoblasts lining the pulp chamber proper gradually changed from tall columnar cells at the basal

end to low cuboidal cells at the occlusal end (Figs 8-10).

The majority of cheek teeth examined had distinct incremental lines; the incremental lines were almost straight and in a near longitudinal arrangement, parallel to the odontoblast layer of the pulp. The incremental lines are almost straight and follow the wall of the pulp chamber up to the level where the odontoblasts become compressed and the pulpal slit is formed. The incremental lines are of consistent pattern throughout the length of the tooth indicating that a steady state of growth and eruption had been present (Figs. 9 &11).

Histological examination of the pulp at the coronal portion revealed complete obliteration of the pulp cavity. Most of the dentine is tubular but near the occlusal end of the tooth the central zone of the pulp filled with the dentine-included cells suggestive of an osteodentine type material. Osteodentine was widespread throughout the pulp. An irregular reparative osteodentine was deposited in the coronal pulp of rabbit molars (Fig. 11). Higher magnification revealed presence of osteodentine that contained many cell lacunae and narrow canals that contained pulp tissue making it resemble bone. The odontoblasts with other pulpal contents were seemed to be incorporated into atubular hard tissue at the occlusal end (Fig.12).

Although the morphology of the rabbit incisors was less complex than that of the molars, the structural features of the pulp and dentine were similar to those of the molars. The rabbit incisor follows the same system as the continuously growing molar. The pulp chamber contained a dental papilla which was composed of mesenchymal tissue and odontoblasts which were producing primary dentine with typical dentinal tubules. Also the histological structure of the cervical loop in rabbit incisor at labial side was consisting of inner enamel epithelium, stratum intermedium, stellate reticulum and outer enamel epithelium. Within a short distance from the cervical loop, the cells of the inner enamel epithelium had developed into ameloblasts producing enamel. On the lingual side the cervical loop is much smaller (Fig.13). Cells within the labial cervical loop are differentiating into ameloblasts and producing enamel covering the labial surface. However, the lingual cervical loop functions as a root analogue, forming epithelium root sheath of Hertwig's and anchoring the incisor in the jaw (Figs.14A&B).

The histological examination of the mandibular incisor revealed that the incisors consisted of a dentine core covered on the labial side by a thick layer of enamel and on the lingual side by thin layer of acellular cementum (Figs.15A&B). At the incisal end the pulp cavity is closed by deposition of osteodentine on its central portion and dentine on its walls. Moreover in most specimens, widespread of osteodentine formation throughout the pulp was observed, including the total occlusion of coronal portion spaces and like bone lacunae was detected in some osteodentine (Figs.15A&B).

III- Histological results of ground sections:

Histological examination of longitudinal ground sections of rabbit molar teeth revealed presence of pulp cavity space surrounded by regular tubular primary dentine at the apical portion of the tooth (Fig. 16.A), while coronal portion showed complete occlusion of the pulp cavity by dentine (Fig. 16.B). In cross section the cheek tooth of the rabbit consists of mesial and distal laminae joined by a narrow bridge of dentine on the buccal side. The distal lamina is smaller than the mesial lamina. The bilaminar cores of dentine are cover by a layer of enamel of variable thickness. External to the enamel or where the enamel is missing, external to the dentine a layer of cementum is generally present (Fig.17)

Transverse ground sections of rabbit molar at coronal portion of the mesial lamina revealed presence of numerous denticles with characteristic tubular structure within the pulp cavity space. The incremental lines denoting rhythmic matrix deposition, in dentine were numerous, well defined and appeared as dark lines, parallel to dentino-enamel junction following its contour and perpendicular to the dentinal tubules (Fig. 18). Transverse sections of the mandibular teeth were found to provide the best results.

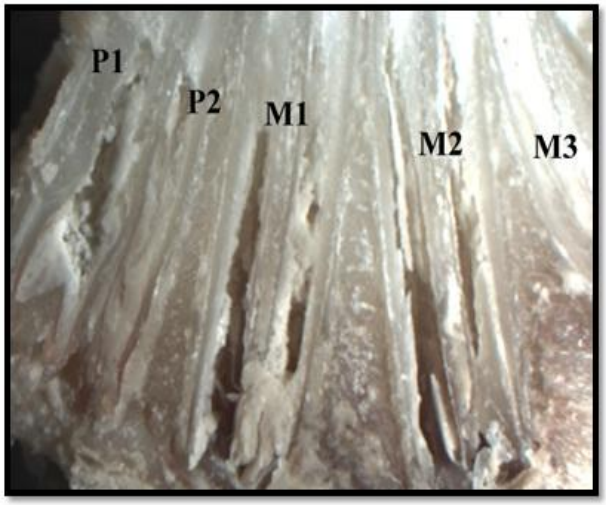

Fig (1): A photomicrograph of the sagittal section of rabbit lower cheek teeth including first premolar (P1), second premolar (P2), first molar (M1), second molar (M2), third molar (M3) and alveolar bone (arrow) **(Stereomicroscopy X 10).**

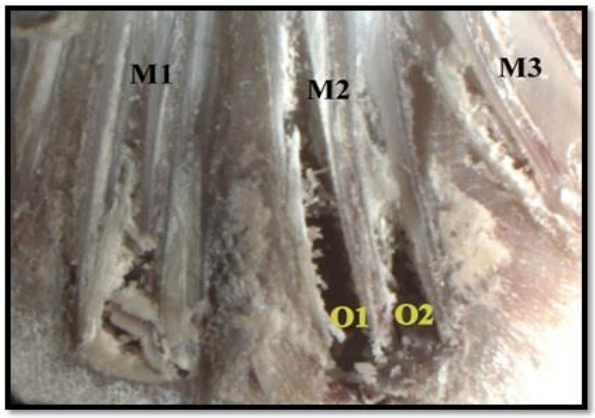

Fig (2): A photomicrograph of rabbit lower molar teeth at 3 month old showing first molar (M1), second molar (M2) and third molar (M3) with characteristic double root openings (O1 & O2), mesial lamina (arrow heads) &distal lamina (yellow arrow) (**Stereomicroscopy X 10).**

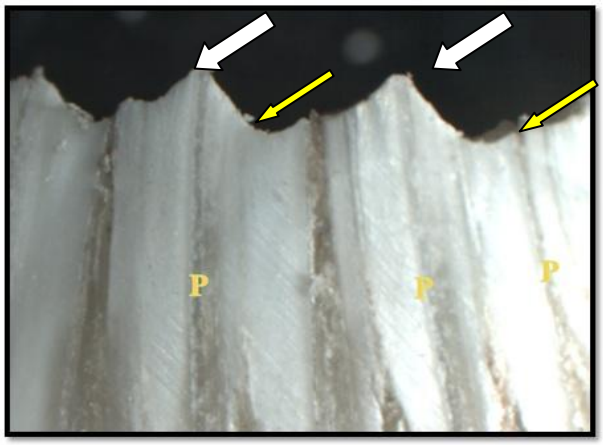

Fig (3): A photomicrograph of rabbit lower molar teeth at 3months old showing nearly completely calcified coronal portion of the pulp (pulp slit) (P), enamel crest (white arrows) and dentinal grooves (yellow arrows) (**Stereomicroscopy X 20).**

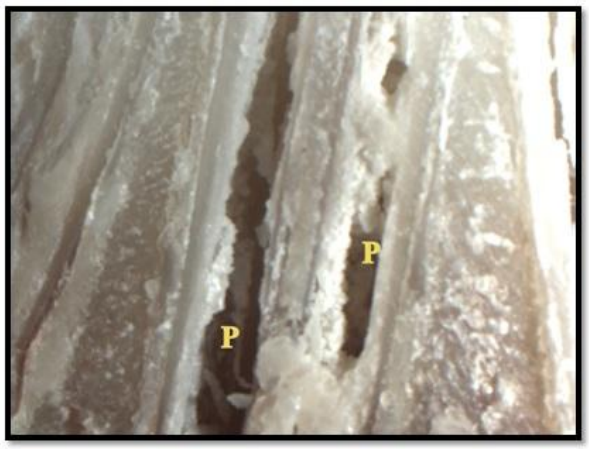

Fig (4): A photomicrograph of rabbit lower molar teeth at 3 months old showing the pulp cavity with internal dentine precipitation (P) (**Stereomicroscopy X 20).**

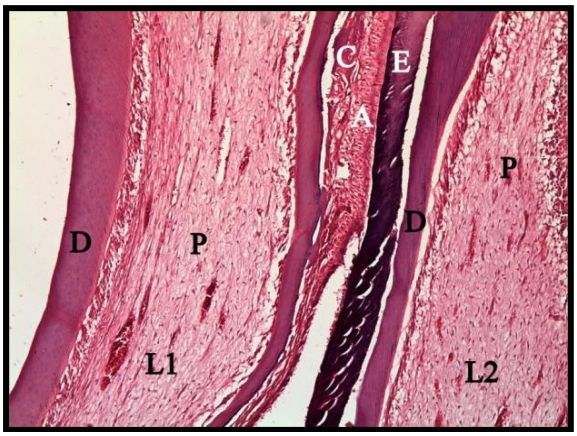

Fig (5): A photomicrograph of rabbit lower molar tooth at 3months old showing its histological structure consisting of two laminae (L1 & L2) aligned mesially and distally, each lamina is formed of dentine (D) and encloses a separate pulp chamber (P) but the 2 chambers merge apically, the 2 laminae are separated by a large groove which is lined by enamel matrix (E), ameloblasts (A) and contains cellular cement (C). (**H & E X 100).**

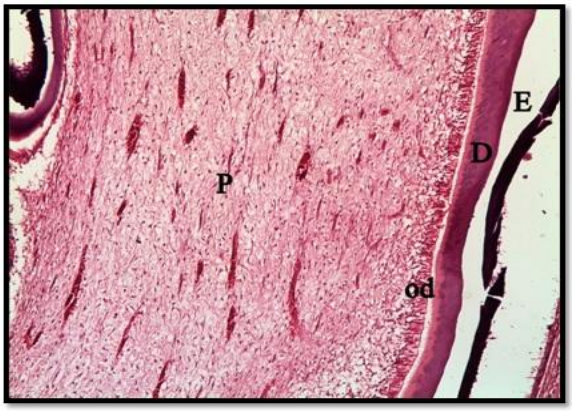

Fig (6): A photomicrograph of rabbit lower molar tooth at 3 months old showing wide pulp cavity near the apical portion (P) lined by odontoblastic layer and covered by dentin (D) and enamel (E). (**H & E X 100).**

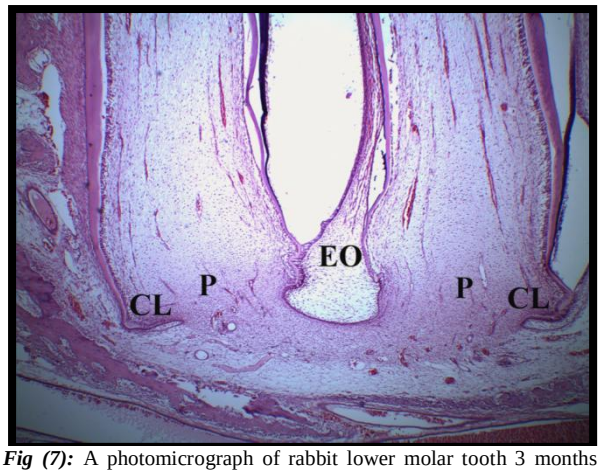

Fig (7): A photomicrograph of rabbit lower molar tooth 3 months old at the apical odontogenic zone showing: the conical pulp cavity which appeared widest at the apex and tapering into the substance of the molar (P), cervical loop(CL) and the continuity of the enamel organ (EO) between the two forming laminae (interlaminar loop) (**H & E X 40).**

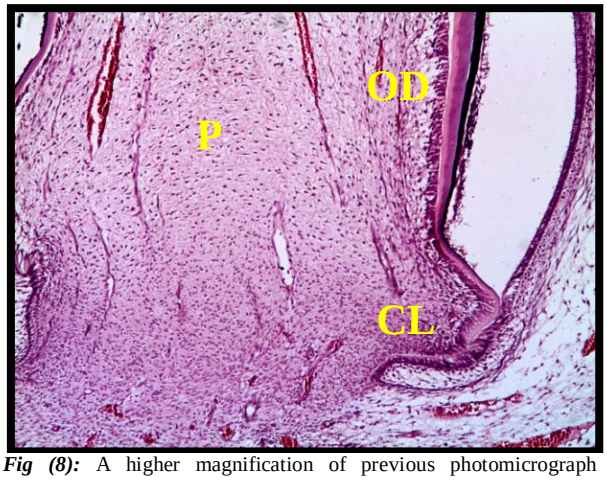

Fig (8): A higher magnification of previous photomicrograph showing the mesial region of the basal part of a laminated molar tooth of the rabbit, the dental papilla (P), a typical cervical loop(CL) with inner enamel epithelium and outer enamel epithelium, tall columnar odontoblasts (OD) in the dental papilla are depositing dentin (**H & E X 100).**

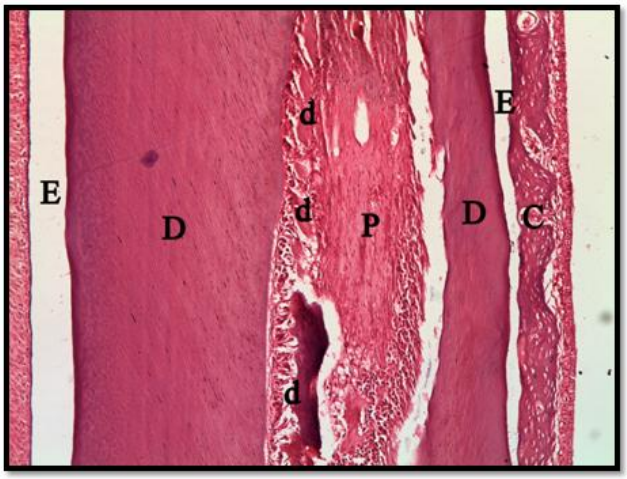

Fig (9): A photomicrograph of rabbit lower molar tooth at 3 months old showing middle portion with numerous denticles (d) along the side of the pulp (P) that covered by dentine (D), enamel (E) and cellular cementum(vascular cementum) (C). (**H & E X 100).**

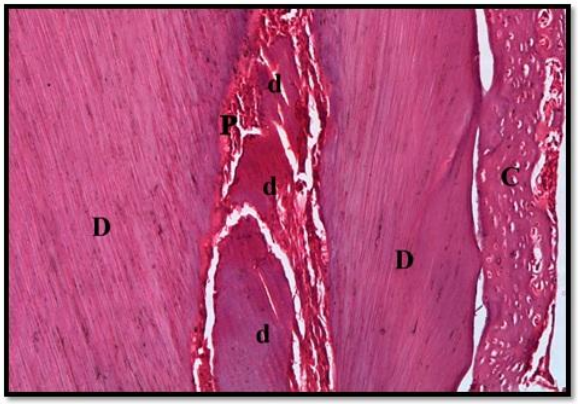

Fig (10): A higher magnification of the middle portion showing numerous large denticles formed of tubular dentine (d) along the side of the pulp (P) (**H & E X 400)**

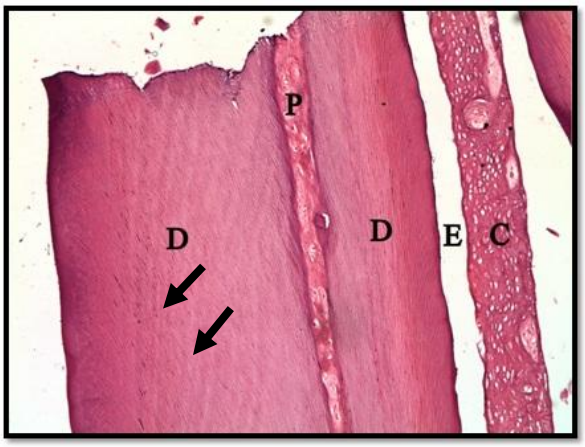

Fig (11): A photomicrograph of rabbit lower molar tooth at 3 months old showing coronal portion with completely obliterated pulp (P) with osteodentine , Note the ongitudinal incremental lines within the dentine (arrow) (**H & E X 100)**

Fig (12): A higher magnification of previous photomicrograph showing complete obliteration of the pulp with osteodentine (OD) surrounded by regular tubular primary dentine (TD) (**H & E X 400)**

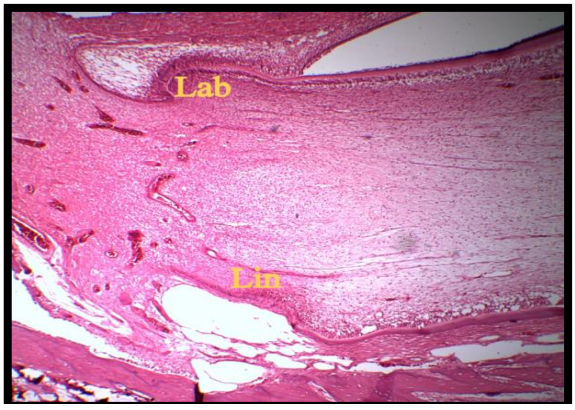

Fig (13): A photomicrograph of sagittal section of a lower rabbit incisor 3 months old at the apical portion of the pulp cavity showing the cervical loop at labial side (Lab) and cervical loop at lingual side (Lin) (**H & E X 40).**

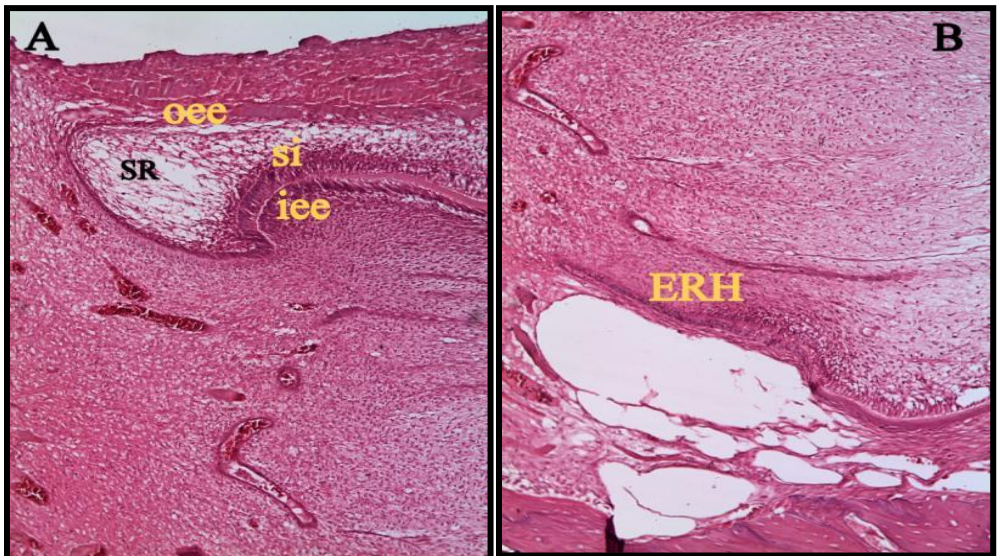

Fig (14): A higher magnification of previous photomicrograph showing (A) labial cervical loop, enamel epithelium (iee), outer enamel epithelium (oee), stratum intermedium, (si) and stellate reticulum(sr). (B) epithelium root sheath of Hertwigs(ERH) . **H & E X 100)**

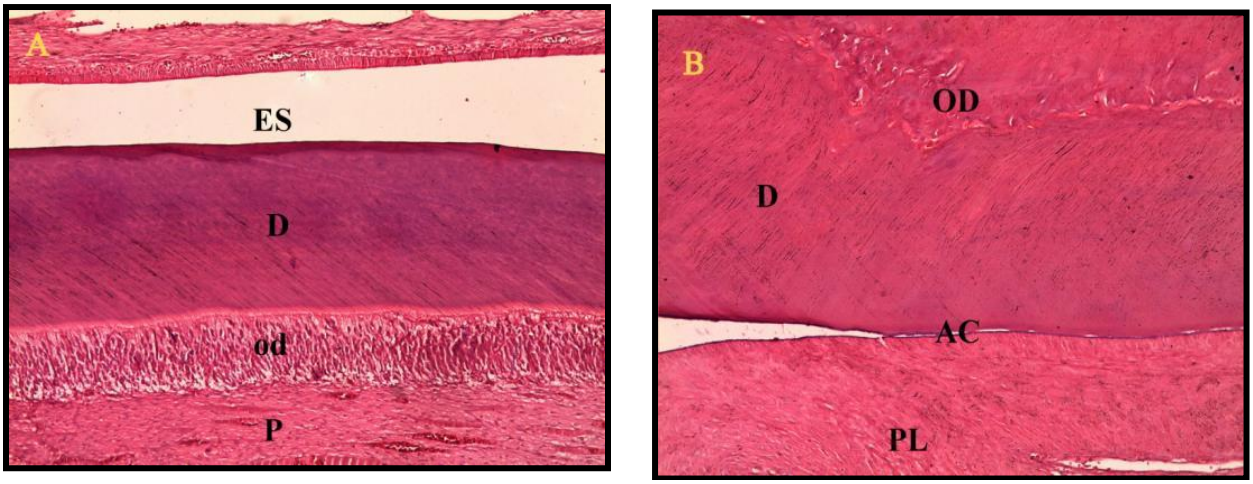

Fig (15): A photomicrograph of rabbit lower incisor tooth at 3months old **(A)** labial side showing ameloblasts (A), enamel space (E), dentine (D), predentine (Pd), odontoblasts(O) and pulp (P)**. (B)** lingual side showing periodontal ligament (PL), acellular cementum (AC), dentine(D),and osteodentine (OD) **(H & E X 100)**

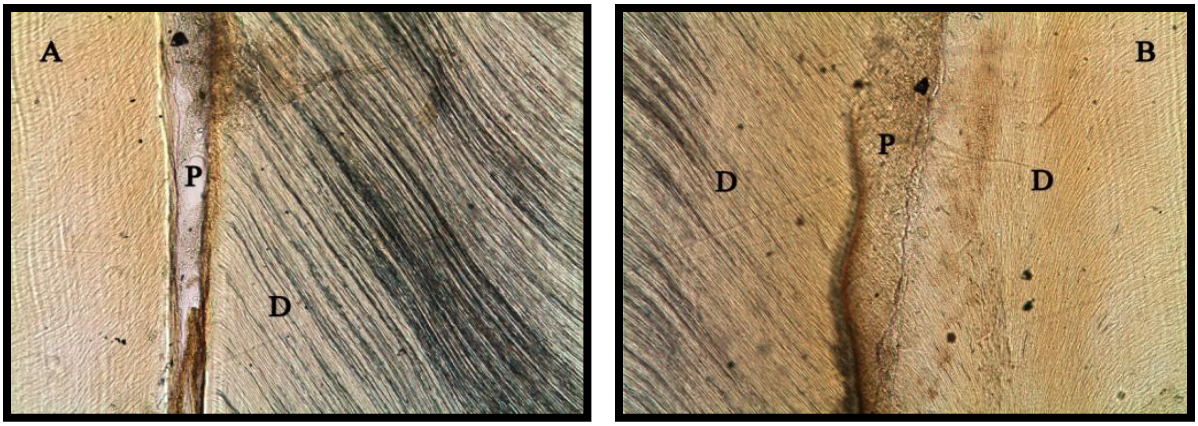

Fig (16): A photomicrograph of rabbit lower molar tooth at 3 months old showing **(A)**apical portion having pulp cavity space (P) surrounded by regular tubular dentine and **(B)** complete obliteration of coronal portion of the pulp (P) with dentine (**Longitudinal ground section X 100).**

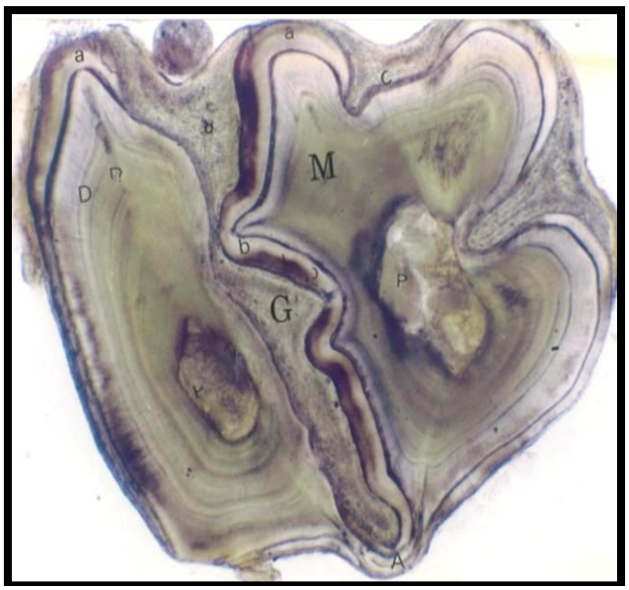

Fig (17): A photomicrograph of rabbit lower molar tooth at 3 months old showing: mesial lamina (M), distal lamina (D), narrow buccal bridge (A), external enamel (a), internal enamel(b), developmental groove (G) and cellular cementum (C). **(Transverse ground section X 25).**

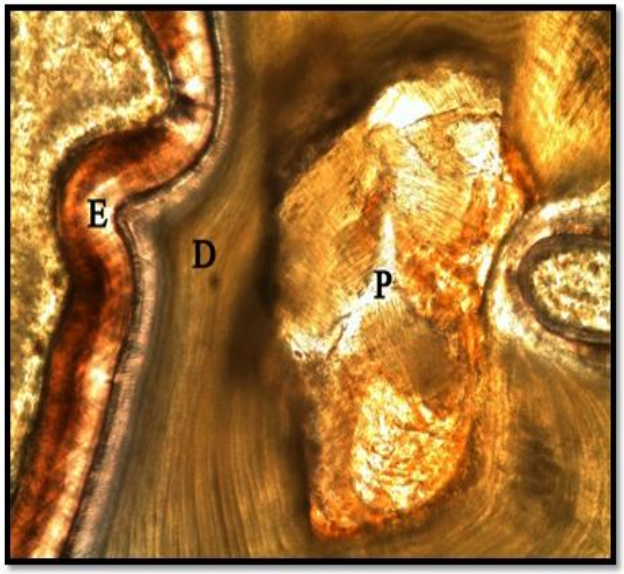

Fig (18): A photomicrograph of rabbit lower molar tooth at 3 months old showing presence of multiple tubular dentine areas (true denticles) within the pulp cavity (P) **(Transverse ground section X 100).**

4. Discussion:

The mammalian teeth can be subdivided into three groups. The first group consists of brachydont or low-crowned teeth where the root is relatively longer compared with the crown. The second group consists of hypsodont, or high–crowned teeth, where the crown is longer compared with the root. The third group consists of the hypselodont teeth, ever-growing or open-rooted teeth that grow continuously during the lifetime of the animal. They also called open rooted teeth that, refers solely to the large apical opening present in all continuously growing teeth and does not imply that the tooth actually needs to have a root in a classical form. The crown never stops growing and root formation is postponed indefinitely, but often with small tracts of dentine covered with cementum acting as regions that attaching the tooth to the jaw bone with a periodontal ligament [(8)].

Lagomorphs differ from other orders in the presence of peg-like second incisors directly behind the grooved upper first incisors. All teeth are hypselodont, and cheek teeth are lophodont. Rabbits have evolved ever-growing (elodont) teeth [(10)]. Rabbits are true herbivores. Their natural diet entails the consumption of large volumes of abrasive high fiber foods. These foods, and the volume consumed, naturally promote teeth wear. As an adaptation, rabbits have evolved ever-growing (elodont) teeth [(20)].

Hypsodonty is the condition of possessing high-crowned cheek teeth that are truly ever-growing. Hypsodont teeth are sometime described as ‘‘ever-growing’’ because dental epithelia remain competent to differentiate the same tissue types in the same proportions throughout the animal’s lifespan [(21)]. Continuously growing or hypselodont teeth could be considered as an extreme form of hypsodonty. It has been proposed that increased crown height is a relatively simple matter of delayed termination of morphogenesis/ cytodifferentiation and that hypselodonty is simply the extreme outcome of such a delay [(22)]. When rabbits chew, the occlusal surfaces of the molars and premolars are gradually worn away. The tissue lost during chewing is replaced by the subjacent tissue which is produced initially at the apical end and transported occlusally by continuous eruption. Tritium labeling studies suggested that in the rabbit molar the cervical loop area is the origin of the epithelial cell lineage [(23)].

Stereo-microscopic examination of sagittal sections of rabbit mandible revealed that the cheek teeth of rabbit consist of two longitudinal parts mesial and distal laminae with characteristic apical root opening .This results in agreement with Crossley [(20)] who suggested that the cheek teeth appear to be composed of three sub-units, these being fused together with cementum. However, horizontal sections and the worn occlusal surfaces revealed that the mandibular teeth are only composed of two subunits and the mesial one having a deeply invaginated enamel fold.

The structure of ever growing cheek teeth is similar to that of other truly herbivorous small species in that they are composed of multiple longitudinal subunits, each containing a pulp cavity; the subunits being fused together by vascular cementum. The cementum deposited between the folds of the tooth structure contains vascular channels. A few of these become occluded, but many remain patent [(24)]. The molars of guinea pigs demonstrated a unique

lamination since a deep fold penetrated the substance of the tooth both on the buccal and lingual sides. Due to the lamination, the basal end of the molars demonstrated a very complex morphology. Mesially and distally, the laminae had a typical cervical loop which consisted of an outer enamel epithelium, a stellate reticulum, a stratum intermedium, and an inner enamel epithelium [25]. Guinea pigs and chinchillas have dentition very similar to rabbits from the anatomic and physiologic standpoint [26].

Histomorphological examination of the dentine pulp complex of the molar teeth of rabbits revealed presence of double root openings. Moreover the rabbit incisor appeared with wide and open pulp at the tooth apex. The lingual side of rabbit incisor is the root analogue with well developed Hertwig's epithelial root sheath and covered with dentin and cementum. The labial side is the crown analogue and covered with enamel. These open-rooted systems are considered as the main cause of continuous eruption. During classic root formation the cervical loop is created at the early morphogenesis of the crown at the cap stage and with root initiation loses its central core of stellate reticulum and stratum intermedium cells, including the putative epithelial stem cells [27-29]. A double layer of basal epithelium is left that is known as Hertwig's epithelial root sheath (HERS) [30]. As HERS proliferates, the growing epithelial sheet becomes discontinuous and forms a fenestrated network lining the root surface known as the epithelial cell rests of Malassez (ERM) [31]. Through this network the follicular mesenchyme cells can migrate to the dentine surface and differentiate into cementoblasts depositing cementum. The ERM functions in the induction of cementoblast differentiation and regulation of their function [32 & 33]. HERS forms in brachydont and hypsodont teeth when root formation is initiated and crown formation ends, and its transition to ERM is generally regarded as a typical feature of root formation. However, in continuously growing teeth a close-up of this area showed that the typical structure of the HERS, consisting only of inner and outer enamel epithelium, was not found. Instead of that the cervical loop was maintained [8].

The present study revealed that the cervical loop at the periphery of the lower cheek teeth and the labial side of the incisor was composed of a core of stellate reticulum surrounded by inner and outer enamel epithelium and appeared at the periphery of the growing end. These findings in agreement with the findings of Tummers &Thesleff [34] They reported that the cervical loop consists of several different epithelial layers. When the crown development is quite advanced the cervical loop has two developmental fate options. It can stick to being a 'crown' and continue enamel production, or it can adopt the 'root' fate. The mouse molar is an example where the entire cervical loop switches to root, whereas the vole molar only partly makes this switch, and maintains the capacity in most of its cervical loop to produce crown.

In hypselodont teeth the cervical loop is an essential structure. The continuously growing molar of the vole maintains its cervical loop during late postnatal development, and that it is present in the entire circumference of the tooth base. It has been suggested that the bulging nature caused by the large stellate reticulum compartment of the cervical loop typical of the rodent incisor is a requirement for a functional stem cell niche [29]. It is thought that the central epithelial tissue of the cervical loop, the stellate reticulum, acts as a stem cell reservoir. In continuously growing teeth such as the rodent incisor the original structure of the cervical loop is maintained and no HERS forms. The stem cells provide the epithelial progeny to sustain the continuous growth [28].

In the current study, the interlaminar loop is showed between the two laminae and consisting of loosely aggregated stellate reticulum in the center surrounded by inner enamel epithelium and outer enamel epithelium . The continuously growing molar of the rabbit was appeared with complex structure. This finding confirms the result of Caton & Tucker [35] they found that the continuously growing molar of the sibling vole has a complex structure. The vole and mouse are both rodents and are closely related species but the vole molar maintains the crown fate and will grow continuously. The epithelium has folded several times into the mesenchyme in a complex manner. These folds run almost all the way to the base of the tooth and create large epithelial compartments that run deep down into the dental mesenchyme. These compartments consist of a basal layer of inner enamel epithelium enclosing a large compartment of stellate reticulum and stratum intermedium. Structurally the intercuspal loop therefore resembles the cervical loop. The cervical loop is a structure that is not restricted to one position but is found in the circumference of the entire base of the tooth.

Histological examination of rabbit incisor revealed the present of large cervical loop at the labial side. This finding was in agreement with those of Kawano *et al.*, [36]and Tummers & Thesleff [12] they found that, in the mouse incisors (elodont teeth) only the labial cervical loop functions to generate ameloblasts that produce enamel on the labial tooth surface. The asymmetric deposition of enamel results in the sharpening of the mouse incisor by single face erosion.

Histological examination of the pulp chamber revealed continuous deposition of dentine to such an extent that, in the coronal portion of the teeth the pulp chamber was almost completely occluded. Therefore, the pulp diminished, and the whole tooth looked like an irregular dentin lump with remnants of pulp tissue in

the center. This could be considered as adaptive function for teeth protection and preservation of teeth vitality. It was also postulated that continuously growing teeth are an animal's adaptation to the extensive wear of its dental apparatus, which could result in loss of life because of premature loss of teeth [37]. There is normally rapid wear of the cheek teeth, around 3mm per month in a wild rabbit [38].

The rate of growth of normal elodont teeth and the shape of their pulp cavities are regulated by the rate of eruption while eruption is largely regulated by the rate of attrition [39]. As elodont teeth grow and erupt the odontoblasts lining the pulp cavities deposit new dentine matrix. The rate of dentine deposition on the walls of the pulp cavity in the elodont teeth of rats and rabbits is generally around 16 microns per day [40].

In the present study the examination of incisors and molar of the rabbit revealed that the calcified tissues in the pulp seem to move toward the occlusal end with the eruptive movement of the teeth and to be worn out eventually. New pulpal tissues generate at the base to replace the calcified materials. Tubular dentine is produced at the apical end and becomes thicker as it moves occlusally. The constant deposition of dentine in rabbit teeth normally prevents pulpal exposure on the occlusal surface as it is worn away by normal attrition. Dentine deposition in most mammals occurs in an appositional manner throughout life. In contrast to the slow incremental circumpulpal deposition of primary and secondary dentine, reparative dentine is believed to be a localized defensive response by the pulp which deposits dentine at specific sites in response to dentinal irritation, although the mechanism controlling its formation[41].

Dentin is laid down incrementally throughout life in the ever-growing incisors of rodents and lagomorphs, with each increment forming a cone-shaped deposit along the pulp cavity. The constant deposition of secondary dentine in rabbit teeth normally prevents pulpal exposure on the occlusal surface as it is worn away because of normal attrition [42]. Moreover teeth provide a record of their formation in their incremental growth and mineralization lines, so histological sections show the history of the teeth. The clinically normal cheek teeth had long thin pulp cavities with a uniform internal structure [43].

Bishop [44] reported that most of the dentine in rabbit teeth is tubular dentine and near the occlusal end, postodontoblasts deposit an atubular tissue which closes the pulpal ends of the tubules and the pulpal contents degenerate and become embedded in the forming atubular tissue. Author added that in rabbit teeth the atubular tissue represents the pulp's reaction to the physiological trauma of mastication at the occlusal surface and prevent direct communication between the occlusal surface and the vital parts of the pulp.

Osteodentine formation was detected in the coronal portion of the rabbit molar teeth. The formation of osteodentine began at the periphery of the pulp and gradually advanced towards the central region. Within the osteodentine, narrow canals that contained pulp tissue as well as many cells were observed. Osteodentine formation was also detected in continuously erupting teeth of guinea pigs in the coronal halves of both incisors and molar. Pulp in guinea pig incisors and molars have revealed a bone-like tissue (osteodentine) with the coronal pulp containing anastomosing blood vessels. In the parts of the pulp where osteodentine was being formed cells become trapped in this irregular dentin. Surrounding the osteodentine there was a layer of normal dentin. In extreme cases, most of the occlusal part of the tooth was composed of osteodentine with only a thin layer of normal dentin adjacent to the enamel [25].

Rabbit's permanent teeth develop a substantial amount of cementum over their enamel surface. Its formation follows the loss of continuity of the reduced enamel epithelium. The cementum which forms within the developmental groove of these teeth contains many cellular inclusions and is of a fibrillar nature that contains recognizable collagen fibrils in its organic matrix. The cementum on the periphery of the crowns, particularly of permanent teeth, is primarily acellular and consists of fibrillar and afibrillar cementum, the latter containing no recognizable collagen fibrils in its organic matrix. Degeneration of some cellular elements of cellular cementum as a result of continuous eruption is accompanied by the appearance of dense bodies resembling lysosomes and autophagic vacuoles within these cells. These changes are not observed in connection with the disappearance of reduced enamel epithelial cells prior to the onset of cementogenesis [45]

In conclusion, rabbit molar teeth are continuously growing and subjected to continuous wear out of the tooth structure. The pulp cavity reveled precipitation of different types of dentine. Middle portion showed presence of large denticles having little number of dentinal tubules while, coronal portion revealed complete obliteration of the pulp chamber with osteodentine.

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Isolation and Characterization of Halophilic Aromatic and Chloroaromatic Degrader from Wadi El-Natrun Soda lakes

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Abstract: Extremophiles are microorganisms able to survive in extreme conditions. They are good candidates for the bioremediation of hypersaline environments and also for the treatment of saline effluents. A novel aerobic bacterial strain has been isolated on the basis of its ability to utilize benzene, and toluene from the extremely saline and alkaline lakes (Soda lakes) of Wadi El Natrun. The growth rates and biodegradation ability were investigated in mineral basic media supplemented with benzene, toluene, and chlorobenzene under various growth conditions including degradation rate in the presence of different salt concentrations. The new isolate was identified by 16S rRNA as *Alcanivorax* sp.HA03. Phylogenetic analysis indicated that our isolate has 99% sequence similarity with most closely related organism *Alcanivorax* sp. TE-9 in the GenBank, which is a hydrocarbon degrading bacterium, *Alcanivorax* sp.HA03 considered as the only reported halophilic alkalophilic strain from genus *Alcanivorax* that can degrade benzene and toluene, This finding may be necessary in order to estimate the true potential of this strain to be applied in the remediation of monoaromatic and chloroaromatic compounds.
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Keywords: Halophiles, Alkalophiles, Soda lakes, Alcanivorax, BTEX degradation.

1. Introduction

Wadi El Natrun and its alkaline inland saline lakes is an elongated depression, about 90 km northwest of Cairo. All lakes had pH values of 8.5-11 and salinity ranging from 283 to 540 g/L (Amany, 1999). Many hypersaline environments such as natural saline lakes, salt flats, solar salterns, industrial effluents, oil fields, coastal ecosystems, are often contaminated with high levels of petroleum hydrocarbons. Crude oil constituted from thousands of components which is separated into saturates, aromatics, resins and asphaltenes.

Among aerobic organisms, there is only a 1-10% occurrence of isolating alkaliphiles. While the two main physiological groups are general alkaliphiles and haloalkaliphiles, all alkaliphiles require some sodium ions for growth and maintenance, making all general alkaliphiles halotolerant to a certain degree. Some of the most highly stable alkaline environments include soda deserts like Wadi El Natrun in Egypt and soda lakes like Kenya's Lake Magadi and Soap Lake, WA (Poolman, 1988; Horikoshi, 1999; Padan *et al*., 2000; Pinkart and Kraft, 2001). Alkaliphiles and haloalkaliphiles have the potential advantage of being able to degrade aromatic and chlorinated hydrocarbons in high pH industrial wastewaters, oil-polluted salt marshes, and other contaminated environments (Margesin and Schinner, 2001).

Many Bacterial strains can degrade BTEX either aerobically or anaerobically but few have been isolated from hypersaline environments. Halophiles with biodegradative potential can be used in the bioremediation of saline environments contaminated with organic pollutants (Margesin and Schinner, 2001, Bastos *et al.*, 2000: Anton *et al.*, 2002). Isolation of halophilic and halotolerant organisms and characterization of their phylogenetic affiliation and metabolic capabilities are important for elucidating degradation pathways and developing bioremediation technologies (Garcia *et al.*, 2004). Halophiles are classified into three groups according to their optimal salt concentration for growth: slightly halophilic (1-3% w/v); moderately halophilic (3-15% w/v); and extremely halophilic (>15 % w/v) (Ventosa and Nieto, 1995). Bacteria prefer lower salinity for optimal growth (Oren, 2002).

Monocyclic aromatic compounds such as benzene, tolune, ethylebenzene, and xylene (BTEX) are common soil and groundwater contaminants and are classified as priority pollutants by the U.S Environmental Protection Agency. Benzene is a category A carcinogen. They are highly water soluble, hence can contaminate a large volume of groundwater. Leakage from underground storage tanks, pipelines, spills, and seepage from surface contaminated sites can cause major BTEX contamination (Philip *et al.*, 2005). BTEX are included in the crude oil, which contains thousands of components which is separated into saturates , aromatics, resins and asphaltenes.

Many microorganisms capable of degrading crude oil components have been isolated. However few of them seem to be important for crude oil biodegradation in natural environments. One group of bacteria belonging to the genus *Alcanivorax* does become predominant in an oil contaminated marine environment (Harayama *et al., 1*999). *Alcanivorax* plays a critical role in the natural cleaning of oil-polluted in halophilic environments. *Alcanivorax* is found in low numbers in unpolluted waters, but in high abundances in oil-polluted waters and coastlines, where it may comprise 80-90% of the oil -degrading microbial community (Harayama *et al*., 1999; Kasai *et al*., 2001; Syutsubo *et al*., 2001).

There are only very few published reports about BTEX degradation under hypersaline conditions Nicholson and Fathepure (2004 and 2005) have reported for the first time that BTEX can be degraded by microorganisms present in hypersaline environments. They were able to develop BTEX-degrading enrichment cultures using soil samples collected from oil-production facilities in Oklahoma as well as from sediment collected from the Great Salt Plain, OK. These studies have demonstrated complete mineralization of 14C-benzene to $14CO_2$ by the enrichment cultures in a medium supplemented with 2.5 M NaCl by microbial community dominant members of the enrichment community, later a pure culture of halophile, *Arhodomonas* sp. strain Seminole was isolated from the enrichment cultures. This organism degraded benzene or toluene as the sole carbon source in the presence of 15 to18 % NaCl(Nicholson and Fathepure, 2005). Li *et al.* (2006) have isolated a *Planococcus* sp. using a contaminated soil obtained from a petroleum refinery effluent in China. The organism is a moderate haloalkaliphilic and able to degrade BTEX at 20 % salt. Overall, there is a severe lack of pure cultures of halophiles that degrade petroleum hydrocarbons under hypersaline conditions. Such studies are necessary to discover novel degradation pathways of hydrocarbon degradation. Isolation of novel microbes with superior degradation potential in the presence of various salt concentrations is important for developing biological catalysts and for developing molecular tools for monitoring the presence of such microbes at contaminated hypersaline environments.

In the present study, We have successfully isolated a halophilic bacterial strain that degrades benzene and toluene as the sole source of carbon. We have studied the isolate's phylogeny, physiology, and capacity to degrade benzene and toluene at various salt concentrations.

2. Material and Methods

Soil samples and chemicals

Samples were collected from Wadi El Natrun soda lakes in Egypt at the time of sampling, the water pH and total salt content of the lakes were within the ranges 9.1–10.4 and 201–360 g l^{-1} ·Soil samples and chemicals, respectively. The dominant cation in the lakes is Na+ (2.1–4.5 M), with traces of Mg^{2+}, K^{+}, and Ca^{2+} (each less than 0.05 M in any of the lakes). The main anion was Cl^{-} (2.1–4.5 M), with lesser amounts of HCO_3^{-} ,CO_3^{-2}, and SO_4^{-2} . The carbonate/bicarbonate alkalinity varied from 0.1–0.8 M, and sulfate was less than 0.3 M. With concentrations of cations other than sodium being very low, virtually all the chloride is presumed to be present as sodium chloride.

Isolation of Benzene and Toluene utilizing Bacterium

Initially, evidence for the degradation of benzene at the soda lakes was obtained using 1 g soil from soda lakes in 50 ml mineral medium (MM) containing 1.5 M NaCl. The enrichment was initiated by adding 1 g of soil (wet weight) to duplicate 100 ml of mineral salts medium (MM). MM contained (in grams/liter): NaCl, 145; $MgCl_2$, 0.5; KH_2PO_4, 0.45; K_2HPO_4, 0.9; NH_4Cl, 0.3; KCl, 0.3. to duplicate one liter-capacity bottles, the air in the headspace served as the source of oxygen. The bottles were closed with a black rubber stopper with a hole in the middle that fit a cut 3-in. tube. The tubes were closed with Teflon-coated septa and aluminum caps. A 100 µl gas-tight glass syringe was used to introduce 22 µl of undiluted benzene and Toluene (~245 µmol) to each bottle. The bottles were incubated static in the dark at room temperature. After one month of cultivation at 30°C, 10 % of the culture was transferred to fresh medium and cultured for one more month. Benzene-degrading halphilic bacterium was isolated on agar plates prepared with MM containing 1 M NaCl with 1.5 % agar. First, a 0.1 ml of 10-fold serial dilution of the enrichment was plated onto agar plates prepared with MM containing 1 M NaCl. The plates were incubated at 30 ºC. Tiny colonies first appeared after a month. The colonies appeared smooth, round, and measured less than 1 mm in diameter. Subsequently, single colonies were aseptically transferred to liquid culture 50 ml of sterile MM-supplemented with 2 M NaCl and 25 µmoles of benzene. Then, benzene degradation was monitored using HPLC.

Phylogenetic analysis

Phylogenetic identification of the isolate was enabled by means of sequence analysis of the 16S rRNA gene. A 3 ml sample of the pure culture was centrifuged at 12,000 rpm for 15 minutes. The supernatant was decanted and the cells were washed twice with sterilized water. The cells were resuspended in 0.5 ml of sterilized water. Then,

genomic DNA was extracted from the pure culture using a MoBio Ultra Clean Soil DNA Kit (MO BIO, Carlsbad, CA). Three primers were used in the amplification of 16S rRNA. These include: Bact 27f (5'- AGAGTTTGATC (A/C)- TGGCTCAG-3'), Bact 1492r(5'-TACGG(C/T)TACCTTGTTACGACTT-3'), and Bact1098r (5'-AAGGGTTGCGCTCGTTGCG-3') (Chang *et al.*,2000). Theoretically, amplification with Bact 27f -1492r should yield 1505 bp and amplification with Bact27f -1098r should yield 1108 bp from the 16S rRNA. Amplifications with these two primer sets were used to obtain the nearly full-length sequence (1453 bp) of the 16S rRNA of the isolate. PCR amplification was performed in a total volume of 50 µl in model T Personal thermocycler (Biometra). Each PCR mixture contained 25 ng of template DNA, 0.6 µM of each primer, 1.75 mM $MgCl_2$, 200 µM of dNTPs, 1.25 U of *Taq* polymerase in Buffer A (M1865, Promega Chemicals, Madison, WI). Amplification of 16S rRNA using both primer sets consisted of an initial denaturation of the genomic DNA at 94 ºC for 3 minutes, followed by 30 cycles of denaturation at 94 ºC for 1 minute, annealing at 53ºC for 1 minute, and extension at 72 ºC for 2 minutes, and a final extension at 72 ºC for 8 minutes. PCR products were checked for expected size on 1.5 % agarose gels. The PCR product was purified by Gene JET^{TM} Gel Extraction kit (#K0691) (Fermentas). After purification, a sample of the PCR product was sequenced in both directions. The determined 16S rRNA gene nucleotide sequences were entered for BLAST searching into the Web site of NCBI (http://www.ncbi.nlm.nih.gov/blast/), and aligned using ClustalW implemented in MEGA software version 3,1(Kumar *et al*., 2004) The phylogenetic tree was constructed using TreeView version 1.6.6.

Growth condition and Growth curve

To quantify growth rate and substrate disappearance, *Alcanivorax* sp. HA03 was grown as described above and cultures harvested during late exponential growth phase by centrifugation at 7000 rpm for 10 min. Cells were washed twice with 50 mM phosphate buffer (pH 7) and resuspended in liquid mineral medium to give an OD600 nm of 0.1, degradation of benzene and toluene were tested in sterilized glass tubes containing 2 ml cell suspension (OD600nm = 0.1) and 2 mM of benzene and toluene as sole carbon source. The test tubes were incubated at 150 rpm and 30°C. At each time point, 2 test tubes were analyzed. For the estimation of the colony forming units (CFU) aliquots were serially diluted, 100 µl aliquots were plated on solid LB medium and the CFUs counted after 2 days incubation at 30°C. Uninoculated tubes and tubes without substrate (with DMSO only) served as controls.

Optimum salt concentration for benzene degradation

The ability of the new isolate to degrade benzene, toluene and chlorobenzen compounds was assessed in flasks containing 60 ml of MM-NaCl and inoculated with 3 ml liquid culture from *Alcanivorax* sp. HA03 and spiked with 1 µl (~25 µmole/Flask) of undiluted benzene, toluene, or chlorobenzene as the sole carbon and energy source. Flasks containing 60 ml MM-NaCl were incubated static at 30 °C in the dark in the presence of different concentrations of NaCl ranging from 3% - 15%.

Effect of other carbon sources on BTEX degradation

The isolate's ability to degrade BTEX and chlorobenzene in the presence of other carbon sources was studied. Flasks were setup with minimal media supplemented with 3 M NaCl and 5 mM of glucose, lactic acid, pyruvate, or Salicylate to determine the effects of these carbon substrates on benzene, toluene, or chlorobenzene degradation.

Data deposition

The 16S rRNA sequence reported in this study has been deposited in the GenBank database under accession numbers JQ015308.

3. Results

Identification of the isolate from soda lakes in Wadi El Natrun

A halophilic bacterium that degrades benzene or toluene as the sole source of carbon was isolated from the soda lakes in Wadi El Natrun. The isolate is a gram-negative, rod-shape halophilic aerobic bacterium. The isolate grew on minimal medium agar plates on benzene vapor within 2-4 weeks. Comparison of the 16S rRNA gene sequence (> 1400 bp) of the isolate with the sequences in GenBank showed 99 % sequence similarity with *Alcanivorax* sp. TE-9 the most closely related organism which is hydrocarbon-degrading *Alcanivorax* strain (Syutsubo *et al.*, 2001), 99% similarity with *Alcanivorax* sp. Qphe 3, which is polycyclic aromatic hydrocarbons, and 98% similarity with the alkane degrading strains *Alcanivorax* sp. 2B5 (liu *et al.*, 2010), *Alcanivorax dieselolei* sp. Nov (Liu and Shao, 2005), and *Alcanivorax dieselolei* strain ANT-2400 S6 (Tapilatu *et al.*, 2010).

Growth of *Alcanivorax* sp. HA03 on benzene and toluene

Alcanivorax sp. HA03 can utilize benzene (Fig. 2) and toluene (Fig. 3) as a sole source of carbon and energy. Growth was accompanied by an increase in colony forming units (CFU) and concomitant decrease in the concentration of benzene and toluene

were verified by HPLC analysis. No growth was observed in the control test tubes containing benzene only. *Alcanivorax* sp. HA03 grew rapidly at 30°C, with a doubling time of 4 hours.

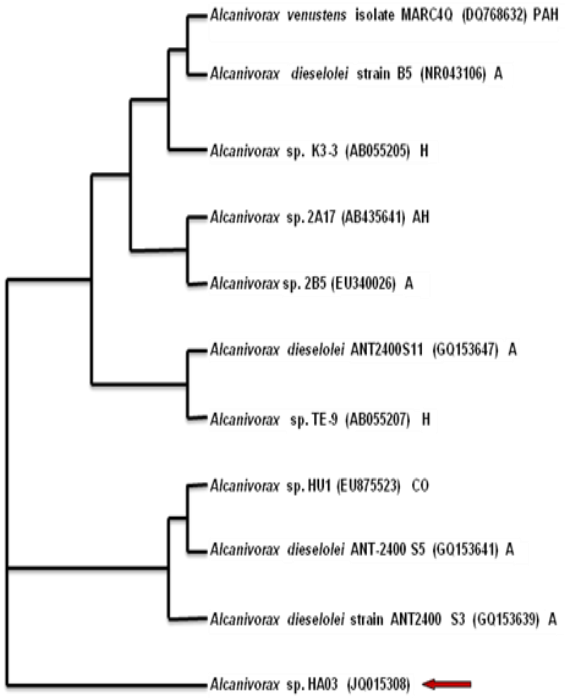

Figure 1 Phylogenetic tree based on 16S rRNA gene sequences showing the relationship of *Alcanivorax* sp. HA03 strain to other reported halophilic *Alcanivorax* strains. Accession numbers of the sequences are shown in parentheses after the strain designation. "A" aromatic degrader, "PAH" poly aromatic hydrocarbon degrader, "H" aliphatic hydrocarbon, and "CO" crude oil degrader.

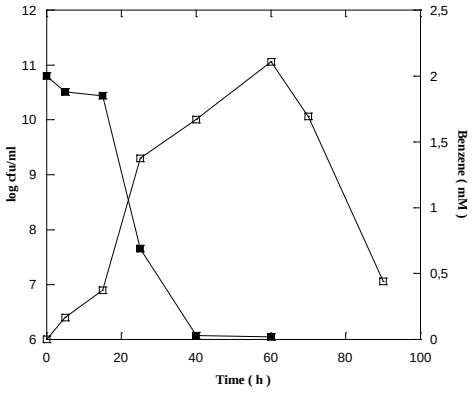

Figure 2 Growth of *Alcanivorax* sp. HA03 on 2 mM benzene as a carbon source. Growth was monitored by following colony-forming units (CFU) and substrate depletion was assessed by HPLC.

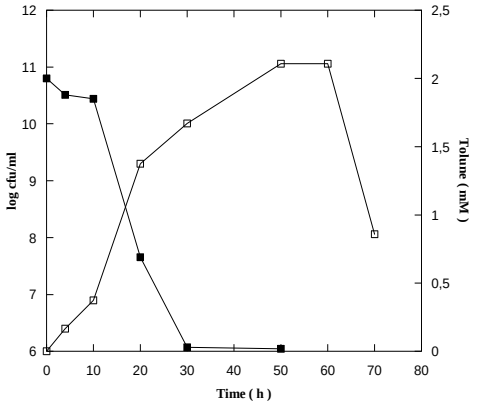

Figure.3 Growth of *Alcanivorax* sp. HA03 on 2 mM toluene as a carbon source. Growth was monitored by following colony-forming units (CFU) and substrate depletion was assessed by HPLC.

Benzene Toluene, and chlorobenzene degradation in the presence of other carbon substrates.

To study the ability of *Alcanivorax* sp. HA03 to degrade hydrocarbons in the presence of other organic substrates, we tested benzene, toluene, and chlorobenzene degradation in the presence of easily metabolizable and common substrates such as glucose, salicylate, lactate, and pyruvate. The results in Table 1 showed that degradation proceeded in the presence of all the tested substrates, except lactate. Results also showed that turbidity was much higher in flasks containing glucose, salicylate and pyruvate than in flasks with benzene, toluene, or chlorobenzene alone. No turbidity was observed in lactate bottles suggesting inhibition of growth and degradation. Data also showed that the rate of benzene degradation alone was more than toluene or chlorobenzene, the degradation also increased in the presence of glucose compared to salicylate or pyruvate. These results clearly showed that the *Alcanivorax* sp. HA03 was able to utilize benzene, toluene, or chlorobenzene alone and with other substrates simultaneously suggesting that, perhaps degradation was catalyzed by constitutive enzymes. This ability of the organism is important for field application.

Benzene, toluene, chlorobenzene degradation rate at different salt concentration

To assess the capability of *Alcanivorax* sp. HA03 to degrade monocyclic aromatic compounds and chloroaromatic compounds in flasks contain different salt concentration ranging from 3% to 15% (0.5 mol l^{-1} to 3 mol l^{-1}) (table 2), 20 µmol of benzene, toluene and chlorobenzene were added as the sole source of carbon for two months. Benzene,

toluene, and chlorobenzene were degraded in 2 weeks at a rate of 2.85, 2.15 and 0.75 µmol/flask/day respectively at salt concentration 3%, while the degradation rate of both benzene and toluene decreased to 1.45 and 1.25 µmol/flask/day respectively by increasing the salt concentration to 7% and needed almost 4 weeks at this concentration. Benzene was degraded at slower rates by increasing salt concentration from 10% to 15% (1 to 0.75 µmol/flask/day), while toluene showed no degradation at those two degradation rates (10% and 15%). No degradation for chlorobenzene occurred at the salt concentration from 7% to 15% when added as a sole carbon source even after incubating for two months.

Table 1 Benzene, toluene, and chlorobenzene degradation in the absence and presence of other carbon substrates by *Alcanivorax* sp. HA03.

Substrate	Degradation rate µmol/flask/day
Benzene	2.85 ± 0.25
Toluene	2.15 ± 0.15
Chlorobenzene	1.25 ± 0.25
Benzene + Salicylate	1.75 ± 0.14
Toluene + Salicylate	1.10 ± 0.23
Chlorobenzene + Salicylate	0.85 ± 0.15
Benzene + Pyruvate	1.60 ± 0.20
Toluene + Pyruvate	0.65 ± 0.10
Chlorobenzene + Pyruvate	ND
Benzene + Lactic Acid	ND
Toluene + Lactic Acid	ND
Chlorobenzene + Lactic Acid	ND
Benzene + Glucose	3.40 ± 0.45
Toluene + Glucose	2.90 ± 0.25
Chlorobenzene + Glucose	1.45 ± 0.10

Flasks were amended with benzene or toluene or chlorobenzene alone or with 5 mM other substrate. The Flasks were inoculated with 5 ml of benzene or toluene or chlorobenzene grown culture. The bottles were inoculated with 5 ml of benzene-grown culture. ND means no degradation

4. Discussion

In spite of high salinity and neumerous hydrocarbon contamination in Wadi El Natrun, surprisingly very few studies have been carried out to understand the microbial communities and their capacity to degrade hydrocarbon contamination either aliphatic or aromatic. In this study, we focused on the biodegradation of benzene, toluene, and chlorobenzene at high salinity from halophilic isolated strain from Wadi El Natrun.

Table 2 Benzene, toluene, chlorobenzene degradation rate at different salt concentration.

	Degradation rate µmol/flask/day		
Salt concentration	Benzene	Toluene	Chlorobenzene
3% NaCl	2.85 ± 0.25	2.15 ± 0.15	0.75 ± 0.54
7% NaCl	1.45 ± 0.72	1.25 ± 0.45	ND
10% Nacl	1.00 ± 0.4	ND	ND
15% NaCl	0.74± 0.9	ND	ND

Several studies showed the ability of bacterial populations associated with the early stages of contamination reflecting the initial utilization of various highly degradable hydrocarbon compound classes aliphatic, aromatic, and polyaromatics (Head *et al.*, 2006). The *Alcanivorax* genus has been associated with the early stages of hydrocarbon degradation and has been shown to utilize saturated hydrocarbons such as straight-chain and branched alkanes (Martins *et al*., 2010).

Alcanivorax sp. HA03 has the ability to grow on benzene, toluene and chlorobenzene as the sole carbon source. From the phylogenetic tree (Fig 1). Based on the 16S rRNA sequence data, it appeared that the isolated strain *Alcanivorax* sp. HA03 may represent a different *Alcanivorax* strain more similar to aromatic degraders than alkane degraders, Figure 1 showed the phylogenetic relationship of the *Alcanivorax* sp. HA03 with other *Alcanivorax* strains that degrade aliphatic and aromatic hydrocarbons that have been isolated from various saline environments. The phylogenetic tree clearly showed that *Alcanivorax* sp. HA03 is different than the reported aliphatic and aromatic strains, formed distinct clusters this phylogenetic clustering is to some extent reflected in their physiology and ecology.

The growth curve for *Alcanivorax* sp. HA03 on benzene and toluene showed the capability of this strain to degade benzene rather than toluene either in the presence carbon source or without carbon source, and even with increasing of salt concentrations. Analysis of the growing *Alcanivorax* sp. HA03 with other carbon source showed that this strain was able to degrade benzene or toluene or chlorobenzene in the presence of easily utilizable compounds such as glucose, pyruvate, and salicylate. However, growth and degradation of benzene was inhibited in the presence of lactic acid. The reason for this inhibition is not known. These observations are important since contaminated sites often contain a variety of easily utilizable substrates.

Our results clearly demonstrated the ability of the isolated halophilic strain from Wadi E1Natrun to metabolize benzene, toluene, or chlorobenzene as the sole carbon source at high salinity. The isolation of benzene degraders over a broad range of salinities (0% - 20%) clearly revealing the natural attenuation

potential of hydrocarbon in the Wadi E1 Natrun lakes. Such ability can be attributed to the adaptation of benzene degrader to temporal and spatial salt concentration in the site.

Alcanivorax not only degrades hydrocarbons in the laboratory, but also seems to be globally very important in the removal of hydrocarbon from salty hydrocarbon contaminated sites. It therefore has obvious potential for bioremediative interventions in polluted salty lakes, marine and coastal systems.

Overall, our study has demonstrated for the first time the ability of genus *Alcanivorax* represented by *Alcanivorax* sp. HA03 isolated from soda lakes in Wadi E1Natrun to degrade low molecular weight hydrocarbons over a broad range of salinity, suggesting the bioremediation potential of hydrocarbons at Wadi E1 Natrun.

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Study of the Association of CYP2D6*4 Polymorphism with the Susceptibility of HCV- Related Liver Cirrhosis and Liver Cancer.

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Abstract: Background: CYP2D6 is a member of cytochrome P450 enzymes family which is involved in detoxification of a wide range of xenobiotics and drugs. Several genetic polymorphisms had been shown to affect its activity which may results in increased susceptibility to malignant disorders. **Aim**: to detect if there is specific cytochrome CYP2D6*4 genotype associated with hepatocellular carcinoma or hepatic cirrhosis among patients with hepatitis C. **Method:** CYP2D6*4 genotyping was performed by polymerase chain reaction restriction fragment length polymorphism (PCR-RFLP). This study includes 23 patients with hepatic cirrhosis, 26 patients with HCC and normal 19 subjects with matched age and sex. **Results:** The frequency of (Extensive metabolizers) EM genotype (wild type) was higher in HCC cases compared to cirrhotic patients and controls (76.8% versus 39.1% and 63.2%).The frequency of (intermediate metabolizers) IM genotype (heterozygous variant) was higher in cirrhotic cases compared to HCC patients and controls (52.2% versus 15.4% and 26.3 %). On contrary, the frequency of (poor metabolizers) PM genotypes (homozygous variant) was the lowest among HCC patients in comparison to cirrhotic patients and controls (3.8% vs 8.7% and 10.5% respectively). Higher frequency of IM and PM genotypes were observed in patients more than 45 years old in cirrhotic and malignant patients. Frequency of IM and PM were significantly higher in males than females in HCC patients (p=0.000). Frequency of p allele was higher in males than females and in older patients than younger patients in the three groups. **Conclusions:** These data indicate that PM CYP2D6*4 genotype has no role in development of HCC and IM genotype may have a role in developing hepatic cirrhosis, while higher frequency of EM genotype may contribute to the progression of HCC in HCV-infected subjects

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Keywords: CYP2D6*4, genetic polymorphism, hepatitis C virus, cirrhosis, hepatocellular carcinoma

1. Introduction

Hepatocellular carcinoma (HCC) is the sixth most prevalent malignant tumor worldwide and ranks the third as a cancer killer, causing more than half million deaths annually [1, 2]. Chronic hepatitis B and C viral infections have been well characterized to play a major role in the HCC etiology. The rates of HCV in Egypt are among the highest in the world, with a prevalence rate of up to 20% [3-5]. However, not all the individuals infected with HBV or HCV develop HCC, other risk factors including environment and genes may be involved in the multistage process of this complex disease [6]. Several studies have reported candidate cytochrome P450 (CYP) genes in which certain alleles are likely to be associated with cancer susceptibility [7].

The cytochrome P450 system is a group of enzymes that are responsible for metabolizing many endogenous and exogenous substances including xenobiotics such as procarcinogens, drugs, and environmental pollutant into more hydrophilic substances [8]. CYPs are encoded by at least 50 different genes grouped in 10 families and sharing approximately 40% sequence homology and are mainly expressed in the liver. In humans, 90% of all of the drugs currently approved for clinical use are metabolized by one of seven CYP isoforms, CYP1A2, CYP2C9, CYP2C18, CYP2C19, CYP2D6, CYP2E1 and/or CYP3A4 [9,10]. As CYP-mediated bioactivation is an initial and obligatory step in chemical carcinogenesis, polymorphisms associated with altered enzyme activities may influence susceptibility to cancer, and specific combinations of alleles may ultimately provide the genetic fingerprint of one's individual ability to respond to chemical and physical environmental agents, endobiotics compounds or infectious agents [11]. This means that altered levels of *CYPs* might be related to hepatocarcinogenesis. It has also been shown that the genetic polymorphisms of *CYP2E*, *CYP2D6* and *CYP2C19* are associated with the development of HCC [12, 13].

CYP2D6 is perhaps the most extensively studied polymorphically expressed drug metabolizing enzyme in humans and its polymorphism has a high clinical importance [14]. CYP2D6 isoform metabolizes more than 25% of most common drugs [15]. The CYP2D6 gene is localized on chromosome 22q13.1. The locus contains two neighboring pseudogenes, CYP2D7 and CYP2D8. The presence of the highly similar closely

located pseudogenes carrying detrimental mutations have through, for example, unequal crossover reactions led to the formation of many of the variant CYP2D6 alleles, which most commonly encode defective gene products [14] . As a result of the presence of more than 70 allelic variants of CYP2D6 gene [16], metabolism and excretion rates of drugs vary between individuals, from extremely slow to ultra-fast. Different phenotypes can be distinguished: poor metabolizers (PM) lack the functional enzyme; intermediate metabolizers (IM) carry 2 different alleles, leading to partial activity; efficient metabolizers (EM) have 2 normal alleles; efficient intermediate metabolizers (EIM) are heterozygous for 1 deficient allele; and ultra-rapid metabolizers (UM) have multiple gene copies [14] . The most frequent inactivating mutation among Caucasians is the splice site G1934A transition (CYP2D6*4 allele) causes a truncated protein. G to A transition at the intron3/exon4 boundary of the CYP2D6 gene leads to incorrect splicing of mRNA resulting in a frame shift and premature termination [17,18] . This allele was previously called CYP2D6B and accounts for more than 70% of all the inactivating alleles in Caucasian populations [19]. This mutation result in decreased or lack of CYP2D6 isoenzyme activity, leading to PM phenotype [20] , increased risk for adverse side effects or therapeutic failure following drug treatment [21] and deficient hydroxylation of several classes of commonly used drugs, environmental toxic chemicals, and endogenous substances[22].

The aim of this study was to detect if there is specific cytochrome CYP2D6*4 genotype associated with hepatocellular carcinoma or hepatic cirrhosis among patients with hepatitis C.

2. Material and Methods:

Patients:

A total of 49 anti-HCV positive patients recruited from gastroenterology unit of Internal Medicine department, Assiut University, Assiut , Egypt were included in the study; 23 patients with liver cirrhosis and 26 patients with hepatocellular carcinoma. Nineteen healthy volunteers with matched age and sex were included in the study. Liver cirrhosis was diagnosed by clinical manifestation (including coagulopathy, hypoalbuminemia, abnormal liver function tests, haematologic evidence of hypersplenism, ascites, jaundice and portal hypertension with or without variceal bleeding), histological findings of liver biopsy and/or abdominal ultrasonography. The diagnosis of HCC was confirmed by a pathological examination or alfa-fetoprotein (AFP) elevation (>400 ng/ml) combined with positive imaging (Magnetic resonance imaging, MRI and/or computerized tomography, CT) The control subjects had no history of any kind of cancer at the time of ascertainment. All subjects gave their informed consent to participate in this study.

Methods:

Eight ml venous blood was collected and divided into: 3ml in tube containing EDTA (ethylene diamine tetra-acetic acid) for complete blood count and DNA isolation, 1.8 ml in tube containing Na citrate for prothrombin time, concentration and INR and the remaining blood were collected in plain tubes. The samples were centrifuged within 30 minutes at 3000rpm for 10 minutes and the serum samples then collected and divided into aliquots and stored at-70^{o}C for further analysis.

Liver function tests were assayed on BME Hitachi 911 auto-analyzer. Serum AFP was measured using chemo luminescence assay on IMMULIT 1000 and specific assay kits (Siemens Lot. No LAPI 0060). Serum HBV markers, antibodies to hepatitis C virus were detected by commercially available micro particle enzyme immunoassay kits (AXSYM, Abbott Laboratories, Germany).

Cytochrome P450-2D6*4 genotyping:

Genotyping of CYP2D6*4 gene was performed by polymerase chain reaction and restriction fragment length polymorphism (PCR-RFLP) technique according to the method described by **Lee *et al.[23]*** DNA isolation was performed by QIAamp DNA mini kit. Cytochrome P450-2D6*4 gene detection was performed by PCR using a set of primer sequences which was designed by **Schur *et al.*** [24] containing the site of the polymorphism (G-to-A transition at position 1934A) as follow: the forward primer 5'-GCCTTCGCCAACCACTCCG-3' and the reverse primer: -5'-AAATCCTGCTCTTCCGAGGC-3'. A total 25 µl reaction volume for PCR amplification included, 12.5µl of 2xGo Taq Green PCR Master Mix (Promega Corporation, US), 2µl of each forward and reverse primers, 5µl template DNA and completed with nuclease- free water to 25µl. The amplification profile was as follow (denaturation at 95ºC for 4 minutes, 30 cycles of: 94°C for 1 minute then ,60ºC for 1 minute then 72ºC for 1.5 minutes and final 72ºC for10 minutes). In parallel with the samples, negative controls containing no DNA were run .The product of PCR amplification were subjected to agarose gel electrophoresis using 1.8 % agarose gel containing ethedium bromide for one hour at 100 volts (355 base pair PCR fragment was indicative of the presence of the gene).

Digestion of the amplified product by Mva-1 **restriction enzyme:** 10 µl of the PCR amplified product was incubated with 0.2µl (2 units) of the restriction endonuclease Mva-1 enzyme, 2.0µl of appropriate buffer (50 mM tris HCL, 100m M NaCl, 10 mM EDTA, 1mM dithiothreitol, pH 7.5 at 37ºC) and 7.8 µl of DNA/RNA free water at 37 ^{o}C for 4 hours. The digested products were electrophoresed on

2% Agarose gel containing Ethidium Bromide. Then the gel was visualized on an UV light for genotyping. Normal allele of CYP2D6*4 (EM) produces two fragments of 250 and 105 bp after digestion with Mva-1 restriction enzyme. G to A transition at position 1934 abolishes the restriction site and a fragment of 355 bp is observed. Heterozygous individuals (IM) show normal allele (250, 105 bp) and one mutated allele of 355 bp and homozygous individuals (PM) showing 355 bp band.

Statistical analysis:

Data were statistically described in terms of range; mean ±standard deviation ±SD, frequencies (number of cases) and relative frequencies (percentages) when appropriate. SPSS Version 17.0 (SPSS Inc., Chicago, IL) was used for all data analyses. Chi-square or Chi Square test were used for contrasts involving categorical variables. For comparisons involving continuous variables, the two-sided two-sample Student *t* test, Welch Modified *ANOVA* were used in cases where the normal distribution assumption or equal variance assumptions were not viable. Odd Ratio (OR with its 95% CI was calculated for the occurrence of PM and IM between cases and controls) A probability value (*p* value) less than 0.05 was considered statistically significant.

3. Results:

Patient's characteristics are summarized in table (1). In table (2) *CYP2D6*4* genotyping data were combined to express 3 categories, as previously described: extensive (EM), intermediate (IM) and poor metabolizers (PM) , frequencies of 3 CYP2D6*4 categories among healthy subjects were 63.2% for EM, 26.3% for IM and 10.5% for PM, in agreement with published data, **Vineis *et al.*** [25]. Genotype distribution differed among the two patients groups; in particular, PM was reduced among HCC compared with cirrhosis patients (3.8 % *vs.* 8.7 %), however there was no statistical significant difference. This finding suggests that PM genotypes may behave as a protection factor in severe liver lesions. On the other hand, EM was significantly increased in HCC group in comparison to cirrhotic group (p=<0.01). As an estimate for the relative risk, the odds ratio for EM genotype was 6.533 with a 95% confidence interval of 1.807- 23.627. These data indicate a higher risk for HCC in individuals carrying the EM CYP2D6*4.

When data was compared with respect to age of the patients, there was higher frequency of IM and PM observed in patients more than 45 years old in cirrhotic and malignant patients. However, frequency of EM was higher in patients less than 45 years old in cirrhotic, malignant and control groups. Frequency of p allele was higher in the three groups in individuals more than 45 years old (Table 3).

When data was compared with respect to sex of the patients, there was higher frequency of IM and PM observed in males compared to females in cirrhotic and HCC group; however there was no statistical significant difference. Frequency of p allele was higher in males than females in the three groups (Table 4).

Table (1): Demographic and Clinical Data in cirrhotic, malignant and control groups

Item	Cirrhotic group N(23)	Malignant group (26)	Control N(19)	*p-value*
Age **Mean ±SD**	49.23±15.01	55.19±8.68	56.84±7.84	N.S
Sex **Male** **Female**	18 (78.3%) 5(21.7%)	22(84.61%) 4(15.4%)	11(57.91%) 8(42.1%)	N.S
Hepatomegaly + -	3(17.61%) 14 (82.4%)	10(38.5%) 16(66.5%)	-	<0.01
Splenomegaly + -	14 (82.4%) 3(17.61%)	13(50%) 13(50%)	-	<0.000
Jaundice + -	7(41.2%) 10(58.81)	10(38.5%) 16(66.5%)	-	<0.001
Ascites + -	9(52.9%) 8(47.1%)	11(42.3%) 15(57.7%)	-	<0.001

p<0.05 is significant

Table (2): Frequency of Cytochrome CYP2D6*4 Genotype in cirrhotic, malignant and control groups:

Item	Cirrhotic group N(23)	Malignant group N(26)	Control N(19)	*p-value*
PM	2(8.7%)	1(3.8%)	2(10.5%)	0.453
IM	12(52.2%)	4(15.4%)*	5(26.3%)	<0.000
EM	9 (39.1%)	21(76.8%)*	12(63.2%)	<0.01

EM= Extensive metabolizer, IM= Intermediate metabolizer, PM= Poor metabolizer, , * *p*-value <0.05 , * Malignant vs. Cirrhotic

Table (3): Association of CYP2D6*4 genotypes and allelic frequency with age :

	EM (No, %)	IM (No, %)	PM (No, %)	E allele frequency	P allele Frequency
Hepatic cirrhosis					
<45 (no=5)	3 (60.0%)	2 (40.0%)	0 (0.0%)		
≥45 (no=18)	6 (33.3%)	10 (55.6%)	2 (11.1%)	0.80	0.20
P value	0.283	0.455	0.605	0.61	0.39
Malignant liver					
<45 (no=1)	1 (100%)	0 (0.0%)	0 (0.0%)	1.00	0.0
≥45 (no=25)	20 (80%)	4 (16%)	1 (4%)	0.88	0.12
P value	0.808	0.846	0.962		
Controls					
<45 (n=8)	7 (87.5%)	1 (12.5%)	0 (0.0%)	0.93	0.07
≥45 (n=11)	5 (45.4%)	4 (36.4%)	2(18.2%)	0.63	0.37
P value	0.244	0.366	0.386		

EM= Extensive metabolizer, IM= Intermediate metabolizer, PM= Poor metabolizer, E= Extensively metabolizing allele, p<0.05 is significant

Table (4): Association of CYP2D6*4 genotypes and allelic frequency with sex :

	EM (No, %)	**IM (No, %)**	**PM (No, %)**	**E allele frequency**	**P allele frequency**
Hepatic cirrhosis					
Male (no= 18)	6 (33.3%)	10 (55.5 %)	2(11.1%)	0.61	0.39
Female (no=5)	3 (60%)	2 (40%)	0 (0.0%)	0.80	0.20
***P* value**	0.283	0.455	0.605		
Malignant liver					
Male (no=22)	17(77.3%)	4 (18.1%)	1 (4.5%)	0.86	0.14
Female(no= 4)	4 (100%)	0 (0.0%)	0 (0.0%)	1.0	0.0
***P* value**	0.400	0.489	0.846		
Controls					
Male (n=11)	5 (45.5%)	4 (36.4%)	2(18.1%)	0.63	0.37
Female (n=8)	7(87.5%)	1(12.5%)	0 (0.0%)	0.93	0.07
***P* value**	0.080	0.267	0.322		

EM= Extensive metabolizer, IM= Intermediate metabolizer, PM= Poor metabolizer, E= Extensively metabolizing allele , ***P*** <0.05 is significant

4. Discussion:

Carcinogenic process in patients with HCV-associated liver disease, mainly cirrhosis, is thought to involve multiple steps, and many risk factors have been proposed. In the clinical setting some patients with HCV-associated cirrhosis progress to HCC, while others never develop HCC. Such a difference in progression to HCC is clinically important, and the factor(s) affecting this difference should be elucidated in such patients. However, this issue remains unsolved. One of the many risk factors is the patient's capability to metabolize xenobiotics (including drug), because some xenobiotics play a role in inducing cancer as procarcinogen or carcinogen [7].

In the present study, Cirrhotic patients, HCC patients and healthy control subjects were compared with respect to genotype frequencies of CYP2D6*4, which have been suggested to alter the enzyme activity. The frequency of mutation of the CYP2D6 allele (PM) was lower in HCC patients than in cirrhotic patients or healthy subjects, however, no statistical significant difference was found. This finding was in agreement with the study of **Agúndez *et al.*** [26], who used the RFLP method and reported that the frequency of mutation of the CYP2D6 allele (PM) is lower in HCC patients than in cirrhotic patients or healthy subjects. They found no significant difference in the frequency of the CYP2D6 allele between the HCC patients and healthy controls. Also, **Kimura *et al.*** [27] found no significant differences between HCC patients and controls in the frequency of the allele. Another study was conducted by **Mochizuki *et al.*** [7] who compared the frequencies of mutation of CYP2D6 allele in healthy subjects with HCC patients. They extracted the genetic polymorphic frequencies of CYP subtypes in healthy Japanese subjects from the review of **Shimizu *et al.*** [28] that summarized the data from many reports and compared the frequencies of mutant alleles in healthy subjects with HCC patients; they found no statistically significant differences in mutant alleles between the two groups. On the contrary to our findings, **Silvestri *et al.*** [11] found an association between the CYP2D6 polymorphism and cirrhosis in HCV patients and hepatomas in patients with chronic liver diseases. They examined the prevalence of various genotypes of CYP2D6 in four groups of patients with HCV: asymptomatic carriers, patients with active hepatitis, cirrhotic patients and patients with hepatoma.

CYP2D6 genotypes have an effect on liver disease progression as shown by the distribution of different genotypes according to the severity of liver lesions [11]. Several studies have shown that the extensive metabolizer (EM) phenotype is associated with increased risk of various cancers [29]]. The relationship of *CYP2D6* genotypes with liver cancer has been explored by **Agundez *et al.*** [26] in a case-control study that compared hospital controls and HCC patients with different etiologies. A significant association with risk was observed for high activity alleles. Our data confirmed these observations as the frequency of EM phenotype was significantly higher in HCC group than in cirrhotic group and normal control (76.8 % vs 39.1 and 63.2% %).The over-representation of CYP2D6*4 EM among HCC patients can be explained in two ways: first, the CYP2D6*4 may mediate the activation of procarcinogenic agents present in environment. Second, the CYP2D6*4 gene may be in a linkage disequilibrium with the causative gene.

It is noteworthy that patients carrying IM or PM genotype with less metabolic activity may not be able to respond to the treatment. Moreover, these patients when treated with normal amount of drug dose, the drug will accumulate in the body and ultimately turns into carcinogen. Alternately, if these patients were treated with lower drug doses, it might lead to drug resistance and poor prognosis. Hence these patients must be treated with caution [30]. In this study, IM genotype frequency was statistically significant higher in cirrhotic group than malignant group (52.2% vs 15.4%). These facts suggested a role for IM CYP2D6*4 in hepatic disease severity and its deterioration toward cirrhosis.

Ageing is the progressive accumulation of more or less random changes that lead to time-related loss of functional units e.g. nephrons, alveoli, or neurons. These time-related changes may explain partly the increased inter-individual variability occurring in drug disposition as people get older [31]. Investigations on the influence of ageing on phase I enzymes in humans have reported conflicting results. Indeed, a study conducted in 54 liver samples from healthy donors from 9 to 89 years did not show changes in microsomal protein content, total P450 or NADPH cytochrome P450 reductase activity with age. By contrast, another study carried out in 226 subjects with histopathologic changes of the liver revealed a significant decrease of 32% in total cytochrome P450 content of liver biopsy samples in subjects >70 years as compared to young adults [32].

In the current study, increased frequency of IM (55.6% and 16%) and PM (11.1% and 4%) were observed in cirrhotic patients and HCC patients more than 45 years old respectively .In contrary to our findings, **Sailaja *et al.*** [33] demonstrated that, patients less than 20 years of age have increased frequency of IM (28.57%) and PM (4.76%) genotype with corresponding increase in P allele frequency. This difference in our results can be referred to the age groups of our patients as most of them were higher than 45 years old and nobody less than 20 years old. Also, the differences in the results obtained in previous researches can be explained by the inter-

individual variability in xenobiotic metabolism and frequencies of these polymorphisms are variable in different populations due to different ethnic backgrounds, environment and lifestyle**.**

In the current study, when data was compared with respect to sex of the patients, there was higher frequency of IM (55.5% and 18.1%) and PM (11.1% and 4.5%) observed in males compared to females in cirrhotic and HCC patients, with higher p allele frequency in males. The present study was in agreement with the study of the **Sailaja *et al.*** [33] who stated that P allele frequency was increased in male patients and PM genotype was found only among male patients.

Conclusion:

PM CYP2D6*4 genotype has no role in development of HCC but may behave as a protection factor int severe liver lesion. IM genotype may have a role in developing hepatic cirrhosis. The high activity allele (EM genotype) associated with HCC may contribute to the progression of HCC in HCV-infected subjects. CYP2D6*4 might serve as a genetic non-invasive marker, enabling identification of HCV-infected patients that are prone to develop cirrhosis or HCC early in the course of the infection.

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Use of GIS and Statistical Analysis to Investigate the Relationship between Atmospheric Pollution and Inversion (A case study: Tehran City)

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Abstract: Climate change has a lot of harmful influence on the environment .Tehran is one of the cities in terms of environmental pollution caused by industrial processes and urban activities. Particulate matter concentrations often exceed threshold values at which human health is severely affected. Atmospheric sustainability resulting from inversion is one of the most important reasons for escalation of potential air pollution in big cities in particular Tehran. Tehran being surrounded in an arch-shaped space of western and south eastern currents doesn't have an effective refining quality. Consequently this situation leads to dangerous phenomena called inversion. Inversion is one of the basic factors in studying the pollution of Tehran. In this study, firstly the statistics of Tehran's inversion during months of fall and spring season were provided on a daily basis from 2006 to 2009 .for a statistical period using meteorology organization's data. In order to classify the pressure, we used operative analysis model. The results show that, the temperature inversion. Was ongoing in Tehran at the time the research was being done in all the seasons of the same year. the most largest circumference of temperature inversion was seen in fall and winter and the most largest circumference was seen in November and January. In this study we have dealt with identifying the most effective sinoptical patterns of inversion in Tehran as well as increasing the occurrence and the percentage of inversion which has direct relation with increasing the pollution.

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Keywords: Inversion, pollution, sin optical patterns, Tehran city, GIS

Introduction:

Tehran is one of the Major cities of the world, which is already suffering from pollution. In some days of the year the amount of pollutant elements increases to the extent that it makes living pretty much difficult to survive. Tehran's geographical position as well as its topographical condition plays some rules in the intensity and frequency of this sustainability and inversion acquired by it.However, inversion occurs in most of the time of the year in Tehran. It's intensity has a direct relation with the dominant sintopical conditions. (Yonesian, 2000)The air pollution reaches to it's peak when the inversion remains in the air with low altitude and long time makes a static and stable barrier which makes mixing this layer with the upper ones impossible and with the increase of the thickness of the pollutants under it, The air pollution increases.The inversion occurs more than 200 times in Tehran. (environmental engineering magazine 1992, page 14).The least inversion height occurs in the end of fall and at the beginning of winter and the height of the inversion has a negative congruence with its intensity.Carbon mono oxide with the side and the speed of the wind and it's negative congruence and thickness has a direct relation with it's inversion intensity. (Deljoo 1999).In 1987 the margin of ten microns has been determined to the airodinamic diameter of the suspending articles by this committee and particles smaller than this due to the power of penetrating in Aloels received the highest health benefits. (calcestine,1987,page 178) Many people lose their lives due to inversion and increasing pollution each year.

In 2009 Alijani studied the synoptical inversion patterns in Mashhad (City located in northern east of Iran) using operative analysis, and investigated different patterns as well as effective patterns in his analysis getting to the conclusion that most of the inversions occur in winter thus they have greatest power and durability. (Alijani 2002).The way of classifying the pressure patterns is the most suitable tool for identifying circulating dominant patterns in a specific time and place. The purpose of this study is to identify possible diversity of having the same pressure patterns of the earth surface during 2006 to 2009, in which the patterns were identified and classified as well as possible time changing as well as identifying and organizing the models which was classified in several different patterns of the models on the basis formation point as follows: In this study we have dealt with identifying the most effective types of inversion in Tehran as well as increasing the occurrence and the percentage of inversion which has direct relation with increasing the pollution.

Methodology:

In this study, first of all the daily statistics of the inversion in Tehran during fall and winter for the statistical period was prepared from 2006 to 2009 using meteorology organization. the (skew-T) map was prepared of all the days (from which the inversion is identified) and it was compared as well as corresponded with the existing

statistic. The pollution of Teheran's stations was prepared form the preservation of environment organization, to analyze the relationship between inversion and pollution.Since the aim of this study is to identify the synoptic systems, the statistics of the pressure of the sea level at: 00 o clock of the days that had inversion was received from NCEP (an internet site) in a digital about 20 to 50 north degree till 30 to 70 east degree and a matrix operation was done on them. In the next round, due to frequency of the days of inversion which made the analysis of the map difficult, the daily pressure data was classified in order to categorize the pressure, the operative analysis was employed. With the help of the operative analysis method, we can manage to classify the weather dominating a place for a specific period of time. The operative analysis method is a way that has been mainly created for decreasing the number of variables. The advantage of this method is that not only it decreases the number of variables but also it preserves the initial quantity of existing variance in the main data. (Alijani 2002).The main confluence factors and the pressure data were decreased to a limited number of factors and finally according to the origin of creation and the existing maps and diagrams and existing of high pressure and low pressure on the earth's surface the effective air types in the inversion of Tehran was detected.

Result and discussion

Having done the study after acquiring the effective patterns on Tehran's inversion which will be shown in the following diagrams we will talk about them:

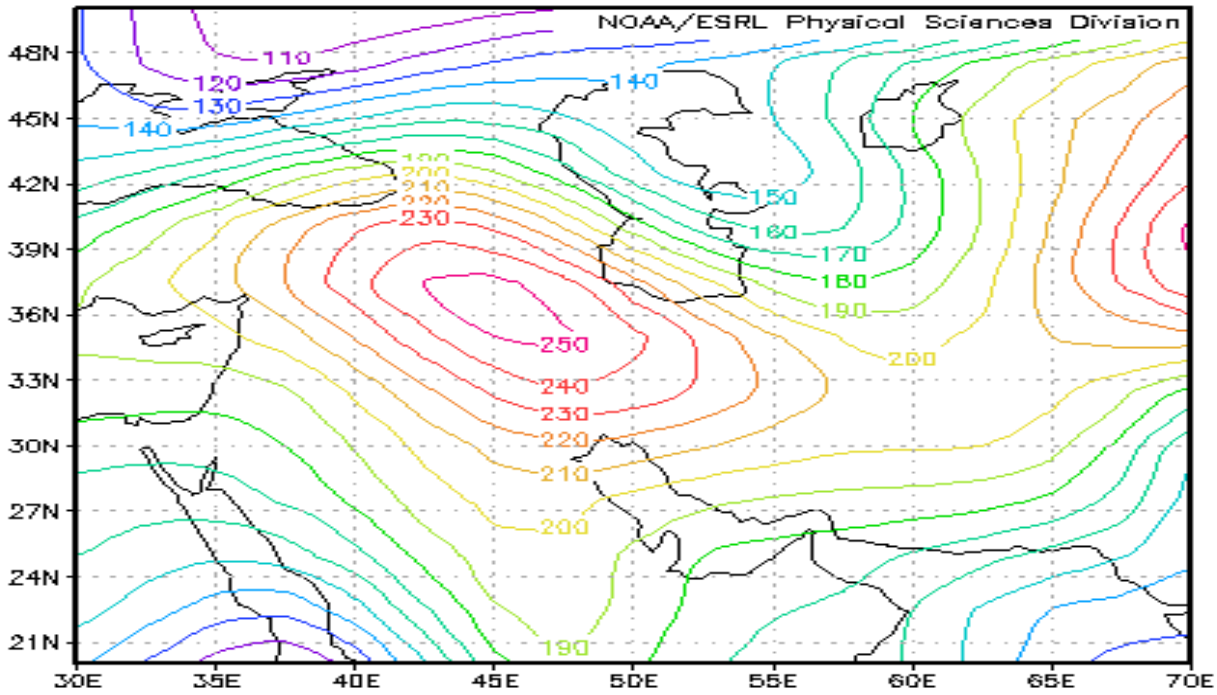
The type of high pressure Zagros pattern (26 Jun 2007)

In type of pattern, the high pressure one over Zagros is located at the epicenter 1025 and at the other point of middle – east and our country, sparks of the high pressure pattern with the curve of 1023 is dominant over Tehran and causes The short time air sustainability, especially at the beginning of the days and causes the pollution to be collected at the lowest surfaces this sort of pressure distribution occurs in late fall and early winter. When this pattern is dominant over Tehran a very great sustainability is dominant over Tehran so that the amount of this mass is more than 7 days that has caused more concentration of pollution in the lowest layer and increasing the amount of pollutants at most stations of Tehran so that the amount of carbon dioxide has exceeded the critic level at some stations.(Table ,1and Graph 1).

Table:1 The Amounts of pollution of Tehran's Station (26 Jun 2007)

Table1: The Amounts of pollution of Tehran's Station (26 Jun 2007)

85/11/06	CO	O3	NO2	SO2	PM-10
Fatemi	130		8		57
Bazar	96		13		
Aqdasieh	119	15	90	64	86
Mehr-Abad	113	54			
Shahr – rey	84	18	66	68	69
Geophysics	201	8	63		64
Sorkhe - Hesar	33	12	18	22	85
Tajrish	173		82	54	142
Pardisan	199	16	43	53	95
Qolhak	106	18	136	67	
Bahman	125		109	40	98
Azadi	261	8	60	81	115
PSI	137	19	63	56	90



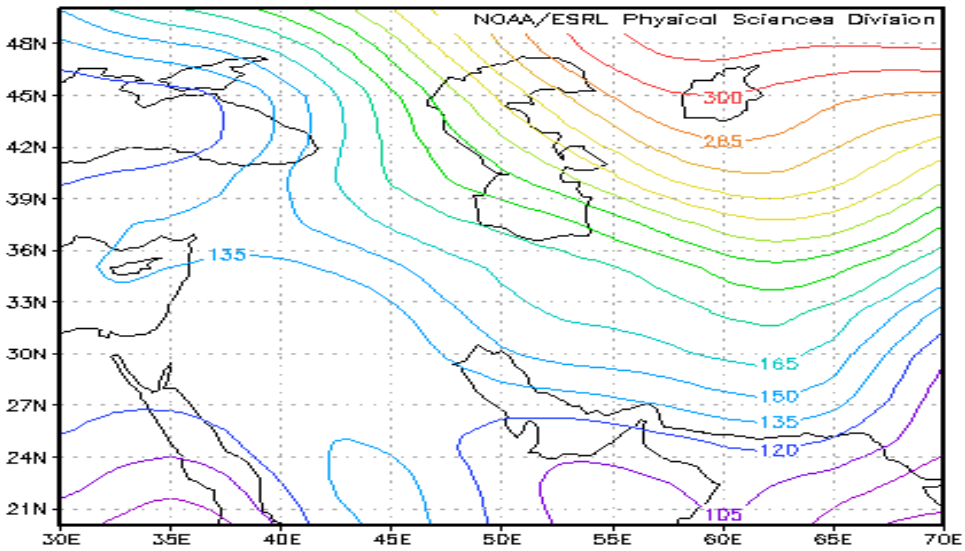
Graph 1: The patterns of sea level pressure (26 Jun 2007)

The type of high pressure Siberia pattern (26 Jun 2007):

In this pattern of high pressure Siberia with 1035 millibars from Siberia ,which enters Iran that carries Siberian cold weather with penetrating the cold weather causes an almost intense air sustainability over Iran.Sparks at this pressure with the pressure of 1018 milibars has been developed over Tehran and even has reached to Eastern parts of Iran which due to creating inversion and lack of air ventilation in lowest layers, the weather of the region will be entirely sustainable and the pollution will relatively be high, which in graph 2 and table 2, the mount of pollution at some stations for 18 Aban 1388 have been shown.

Table 2 - the amount of pollutions at Tehran's Stations (9 No, 2009)

88/08/18	CO	O3	NO2	SO2	PM-10
The governer's office	165	10	38	51	68
Aqdasieh	84	38	37	57	46
Rose park	49	17	19	42	35
Punak	43	47	30	30	31
Geophysics		21	25	13	45
Shahre – rey	99	51	21	28	47
City hall district four	59	9	35	32	74
City hall district 11	52		25	33	87
City hall district 10					
City hall district 16				45	62
City hall district 19	81	30	22	40	67
Golbarg	38	7	15		51
Maweoudieh	30	42	20	23	43
Azadi	179	38	36	90	93
Imam Khomeini					
Bahman	54		65	27	71
Pardisan					
Tajrish	85		31	45	75
Sorkhe – Hesar	18	66	27	14	54
Qolhak	51	55		56	121
PSI	72	33	30	39	63



Graph: 2- the pattern of sea level pressure (9 Nov 2009)

Conclusion:

In this study we have employed the operative analysis method then arrangements of similar patterns has been classified at the same level and out of these similar patterns of one system for a specific day in which the amount of patterns for that day was prepared and then it was studied and analysed on the basis of dispersion of pressure for dominant types.

The results show that the inversion during the course of study in Tehran has been settled in all seasons and due to qualification the inversion conditions, the temperature sustainability of the earth's surface has been settled and 80 percent of the days of four years was studied under the dominant inversion conditions, but the height of the layer of inversion varies according to changing the seasons, and the greatest circumference of the inversion has been in fall and winter according to the maps of s kew-t. and the greatest amount of circumferences has been in November and January. Also out of these pattern types 1,4 and 5 the patterns related to the simultaneous mass above Iran north east over(Aral lake) and north - west and east of Turkey. The pattern related to high- pressure Siberia. It became evident in studies done that usually most of the inversions occur in late fall and winter and winter inversions have more power and continuity.

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Tarbiat Modarress masters dissertation.

Survay the Effect of Transformational Leadership on Organizational Culture in Petrochemical Industry in Iran

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Abstract: The external environment for many companies nowadays is characterized by turbulence associated with globalization, changing customers and investor demands, increasing product market competition, technology growth, considering knowledge and learning as the main assets of organizations and rapid increasing change and chaos. Some management sages advocated new "generative transformational" forms of learning to deal with an external reality in which everything is constantly evolving or "becoming". In this study, we illustrate the effect of transformational leadership on organizational culture. The population of the research consists of 250 people of managers of the companies of Petrochemical industries in Iran. A sample of 152 subjects was selected as statistical sampling .The results of the study support the hypotheses. Transformational leadership has a positive and significant correlation with the components of organizational culture such as Trust, Collaboration, Learning and Formalization .
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Keywords: Transformational Leadership; Organizational Culture, Organizational learning, Formalization, Trust.

1. INTRODUCTION

The purpose of the study is to investigate the Relationship between Transformational Leadership and Organizational Culture in Petrochemical Industry in Iran.The term leadership has been very widely referred in the literature. Political experts, business executives, social workers and scholars use it in their speeches and writings. Although many theories and theoretical formulations of the leadership concept have been introduced throughout the years, there is still disagreement as to its meaning.

Leadership is defined as a behavior or a process by some scholars. For instance, Bowers and Seashore (1966) gave the concept as "an organizationally useful behavior by one member of an organizational family toward another member or members of that same organizational family". Tannenbaum and Massrick (1957) treated leadership also as a process or function rather than as an exclusive attribute of a predetermined role. They suggested that the leadership role in this process often shift from one person to another. Many researchers also look at leadership from the long / short term orientation point of view. Mescon (1958) said that "true leadership can and must transform a group from a mere collection of individuals into a vital force, capable of goal attainment to a degree which will not be possible in case of an unstructured group of people"[25]. Some scholars contributed to this view by underlining the importance of the influence on the subordinates to attain the common goals. For instance, Tannenbaum and Massrick (1957) defined leadership as "an interpersonal influence, exercised in a situation and directed through the communication process, toward the attainment of a specific goal or goals". Parallel with this view, Bennis (1959) also suggested that the only tool for a leader to become effective is his / her skill to influence others[7]. Dion (1968) defined leadership as "a relationship between one or more persons exercising influence and one or more persons submitting to that influence"[13]. Leadership is also seen as extraordinary personality characteristics. Bass (1990) claimed that leaders are extraordinary people with specific and exceptional sanctity and heroism, who can set an example for their followers[5]. On the other hand, Jago (1982) defined leadership as both a process and property. According to him, leaders create a process by using noncoercive influence to direct and coordinate the activities of the members in an organization toward the accomplishment of group objectives.[19]

New attitude towards leadership in inclusive organization emphasizes on the finer and more important points. In an inclusive organization, leaders are designers, supervisors and teachers. Their responsibility is providing organizations where people continually develop their abilities to recognize complexities, make goals clear, and develop mental models. This means that leaders are responsible for employees learning [33].

It should be noted that the correspondence

among new leadership tasks is one characteristics of transformational leadership. In order to having better understanding about transformational leadership, it can be said that most of the classical studies have focused on aspects of leadership that was compatible with maintaining the status quo and meet the standards of work, called interaction-oriented leadership. Nowadays, more emphasis is on the characteristics and behaviors that are compatible with charismatic leadership, namely transformational leadership [20].

Most theorists stated common factors for transformational leadership such as inspiration, part attitude, charisma, human communications, consideration to the feelings of staff, learning development and stimulating the minds of followers, establishing emotional connections with employees, [6].

Transformational Leadership

Researches on leadership are focused on how leaders create and strengthen the organizations during 1980' s. Transformational leadership is created to be succesfull in reaching the goals of the organization, increasing the commitment to the organization and strenghten the process during these objectives of the organizations [38].

Transformational leadership integrates ideas from trait, style and contingency approaches of leadership [15]. In the light of findings throughout the years, some characteristics of transformational leaders can be stated as follows:

- They change the core values of followers for the benefit of the common interest by committing people and seeing them as ends not as means,
- They inspire followers to go beyond their own self-interests for the good of the organization with their vision [2].
- They are proactive, raise follower awareness for transcendent collective interests and motivate followers to achieve out of range goals [3].
- They are capable of having profound and extraordinary effects on people by causing shifts in the beliefs, the needs, and the values of followers, so followers can become leaders themselves [22].
- They heighten the awareness of followers with vision they create and the strategies for reaching them [2].
- They create self-confidence in followers by empowering them,
- They tend to direct specific activities as much as to alter moods, to evoke symbolic images and expectations, and to inspire desires and objectives [16].

Dimensions of Transformational Leadership

In this study, we are supposed to measure transformational leadership dimensions proposed by Rafferty and Griffin [30]. The studied dimensions are as follows:

1) Vision: We identify vision as an important leadership dimension encompassed by more general construct of charisma. Bass (1991) argued that the most general and important component of transformational leadership is charisma [5].

2) Inspirational communication: Transformational leadership goes beyond the cost-benefit exchange of transactional leadership by motivating and inspiring followers to perform beyond expectations [6] and inspirational motivation has been identified as an important component of transformational leadership.

3) Supportive leadership: staffs show their interest when leadership shows developing tendencies toward his/her employees, paying personal attention to his/her employees and appropriately meeting their needs [30].

4) Intellectual stimulation: This leadership factor encompasses behaviors that increase followers' interest and should be aware of their problems, and that develop their ability and propensity to think about problems in new ways [6].

5) Personal recognition: In such a system of rewarding, in response to achievement of visions, which is agreed upon, various types of rewards are given. In this study, "personal recognition" is chosen; because among contingency rewards, it is more compatible with the transformational leadership. Personal recognition was defined as follows: “The provision of rewards such as praise and acknowledgement of effort for achievement of specified goals” [30].

Organizational culture

The culture of an organization influences the way in which practitioners learn and share knowledge.Workforce diversity in globalized business reflects a multitude of cultural and ethnic backgrounds, shared values that blur potentially sharp cultural differences. The cultural differences from country to country necessitate aligning corresponding differences in management practices. Resultantly, the success or failure of knowledge management within organizations depends on 'culture', an emerging pre-requisite for effective knowledge management.

Deshpande and Webster (1989) define organizational culture as the set of shared values that help organizational members understand organizational functioning and thus guide their thinking and behavior [14]. Researchers argued that culture is a complex system of norms and

values that is shaped over time and affects the types and variance of organizational processes and behaviors [4]. Organizational culture as a concept is considered to be a key element of managing organizational change and renewal (Pettigrew, 1990). Thus, culture is a sort of glue that bonds the social structure of an organization together. Hofstede, (1991) called culture the "Software of the mind".In the competitive environment the organizations have to change its culture in order to survive otherwise, it may be even counterproductive [21]. Four types of culture are found in organizations is power culture, role culture, support culture and achievement culture [27].

Organizational culture provides its members an understanding to work through the basic problems of survival in and adaptation to the external environment as well as to develop and maintain internal processes [24]. Schein (1999) stated that organizational culture is the property of a group and it is a powerful, latent, and often unconscious set of forces that determine both our individual and collective behavior, ways of perceiving, thought patterns, and values [32].

Spender (1983) stated that organizational culture is a belief system shared by an organization's members. Being one of the pioneer authors in this concept Ouchi (1981) dealt with symbolic aspects of the concept and defined the term a set of symbols, ceremonies and myths that communicate the underlying values and beliefs of that organization to its employees [28].

Dimensions of Organizational Culture

Alavi, Kayworth & Leidner (2005) cite expertise, formalization, innovativeness, collaboration and autonomy as the values of organizational culture that lead to effective knowledge management [1].

The current study, focus on trust, collaboration, learning and formalization, as cultural factors of knowledge creation process:

1-Formalization

In work setup formalization refers to rules, procedure and written documentation such as policy manuals and job descriptions (Daft, 2001). Graham and Pizzo (1996) argued that effective knowledge management requires a balance between open and flexible organization system along with formality and discipline to ensure tangible output. The study, contend that structured and standardized procedures are needed to capture, control and connect knowledge. Although, a general belief that formalization inhibits creativity and innovation and thus knowledge management. However, the empirical evidences do not support the concept, as more innovation and creativity have been found in more formalized setups [11].

2-Trust

Trust is the most important explicitly stated value essential for knowledge management. Lopez et al. (2004) stress that an atmosphere of trust and security is essential to encourage innovation, experimentation and risk taking in order to develop new knowledge and use existing knowledge . Trust has been defined as an expectation that arises within a community of regular, honest and cooperative behavior, based on commonly shared norms, on the part of other members of that community [17].

3-Learning

Organizational learning is synonymous to capacity to innovate and related to the ability to apply knowledge in organizations [36]. A learning process relating to use of conceptual knowledge enhances the employees' knowledge applicative capability [37]. A learning culture opens up formal and informal channels of communication [8]. Learning is found to be a predictor of knowledge creation [11]. Bhatt (2000) relates individual learning capability and organizational learning culture to broadening of knowledge base. Strong learning culture of firms is linked to creation, acquisition, and transfer of knowledge [26].

4-Collaboration

Collaboration is the degree of active support and help in the organization. Collaboration is defined as human behavior sharing of meaning and completion of activities with respect to a mutually shared goal and taking place in a particular social or work setting [35].

Delong and Fahey (2000) cited interactivity, collaboration, sharing and teaching, dealing with mistakes, orientation to existing knowledge as the cultural characteristics, shaping social interaction in the context of knowledge management. Lopez et al., (2004) empirically identify collaborative culture as a means to leverage knowledge through organizational learning .A culture of collaboration helps in knowledge creation by increasing knowledge exchange [23].

The Effect of Transformational Leadership on Organizational Culture

Bass (1997) affirms that transformational leadership is universally effective across cultures, and that this century's dominant workforce consists of knowledgeable employees who need the envisioning and empowering that can be provided by transformational leaders. Ergeneli et al. (2007) assert that increasing globalization, new technological imperatives, common industrial logic and global

technologies and institutions serve to harmonise management practices. Therefore, global managers need universally valid leadership theories and principles that transcend cultures. Thus, it is expected that there will be various similarities in beliefs regarding effective leaders' behaviour across cultures. However, Bass and Avolio (1990) argue that some studies in many different societies show that transformational leadership is closer to perceptions of ideal leadership. On the contrary, some writers claim that there are universal tendencies of leadership that support the culture-universal position [2]. The role of leadership in creating culture is almost an indisputable reality in organizational theory. One of the most prominent author that suggested this reality is Schein (1985) who stated that organizations do not form accidentally, instead they are goal oriented and created because one or more individuals perceive that a coordinated and concerned action of a number of people can accomplish. [32]. Transformational leaders have a high role on creating the organizational culture. The values, that transformational leader adopted, can also be adopted easily by the employees. It is important to have a good skilled transformational leader because he / she is taken as a model by the employees in the organization. If the leader has personality and behavioral disorder, the organizational culture can be effected by this disorder problems. This irregular atmosphere at the organization damages the employees working atmosphere and reaching the common goals become difficult. Transformational leaders are the ones who can create the culture of the organization, help employees to involve in the culture and make it his / her own and try to make organizational culture stable in the organization by his / her good communication skills and leadership ability [32].

Hypothesis 1

There is a positive relationship between Transformational Leadership with Organizational culture .

Hypotheses 2

2-1- There is a positive relationship between Vision and Organizational culture .

2- 2- There is a positive relationship between Inspirational communication and Organizational culture .

2- 3- There is a positive relationship between Intellectual stimulation and Organizational culture .

2- 4- There is a positive relationship between Supportive leadership and Organizational culture .

2- 5- There is a positive relationship between Personal recognition and Organizational culture .

2.Materials and Methods

This study is an investigation and correlational research. The population of the research consists of 250 people of managers of the companies of Petrochemical industries in Iran. A sample of 152 subjects was selected as statistical sampling.

Organizational culture scale (OCS) measured the four attributes of organizational culture. The OCS in current study consists of 13-items; 4 for Collaboration, 3 each for Learning, Trust and Formalization. The scale was rated on 7-point Likert -type scale, with 7 indicating "Strongly Agree" to 1 indicating "Strongly Disagree". The Transformational Leadership Scale was adapted to measure Transformational Leadership . This version consisted of 29-items questionnaire that measure the five dimensions of Transformational Leadership, however in the present study 5 items measuring the Transformational Leadership was used. The items were rated on a 7 point Likert's type scale, ranging from (1) ,Strongly Disagree to (7) Strongly

The statistical procedures relevant to this study include descriptive statistics (frequency tables for biographical variables, means, standard deviations and Cronbach's alpha coefficient and inferential statistics, which included Pearson's correlation and Regression Analyses.

The data collected were processed with the Statistical Program for Social Science (SPSS) version 16.1, which is the most current software.

Agree. Based on table (1)and table (2),the internal consistency reliability estimates for the Transformational Leadership dimension was 0.85 and the Organizational culture was .82. According to Pearson correlation test, correlation is significant which are indicated in tables (3) and (4). Thus, null hypothesis can be rejected. The reason is that Sig. is lower than 0.05 .

Table (1). Variables' reliability statistics

Variables	Cronbach's Alpha
Transformational Leadership	0.85
Organizational culture	0.82

Table (2). Dimensions' Reliability Statistics

Organizational culture dimensions	Cronbach's Alpha	Transformational leadership dimensions	Cronbach's Alpha
Formalization	0.905	Vision	0.906
Trust	0.906	Inspirational communication	0.815
Collaboration	0.830	Intellectual stimulation	0.926
Learning	0.817	Supportive leadership	0.913
		Personal recognition	0.921

3-**Results**

Correlation Test of all variables along with

alpha coefficient values calculated in order to establish the validity and reliabilities of the instruments, shown in Table 3.

According to the Pearson correlation test (table3), null hypothesis can not be rejected. It means that the existence of a significant relationship between and organizational culture in companies is at 0.95 degree of confidence. As it illustrated in table (3),(4) the relationship between Transformational Leadership and every dimension of organizational culture is significant

Table 3. Pearson Correlation between Transformational leadership and Organizational culture

	Organizational culture	
Transformational leadership	0.521	Pearson correlation
	0.036	Sig. (2-tailed)

Table 4. Pearson correlation test of Variables

Independent Variables	Dependent Variables	N	Sig	Result
Vision	Organizational culture	152	.000	Not Rejected
Inspirational communication	Organizational culture	152	.000	Not Rejected
Intellectual stimulation	Organizational culture	152	.000	Not Rejected
Supportive leadership	Organizational culture	152	.120	Not Rejected
Personal recognition	Organizational culture	152	.000	Not Rejected

In order to verify the direct/predicting effect of Transformational leadership on organizational culture attributes, (Vision, Inspirational communication, Intellectual stimulation, Supportive leadership and Personal recognition) .Multiple regression was computed and has showon in Table 5, the value of R2 explains 23. % of the variance in the scores for Organizational culture accounted for by the Transformational leadership dimensions.

The regression results partially support the hypothesis, as significant contribution to the Organizational culture is made by vision, Inspirational communication, Intellectual stimulation, supportive leadership, and Personal recognition has shown significant impact.

Table 5. Result of Multiple Regression Analyses for Transformational leadership on Organizational culture

Variables	*B*	*SE*	*ß*	*t*	*p*
Vision	***11.06***	***.70***		***17..88***	***.000***
Inspirational communication	***.18***	***.05***	***.15***	***2.63***	***.000***
Intellectual stimulation	*.25*	*.03*	*.232*	*5.01*	*.000*
Supportive leadership	*.07*	*.03*	*.06*	*1.53*	*.120*
Personal recognition	*.30*	*.05*	*.25*	*7.36*	*.000*

Df =(4,152), R2 = .230, *p <.001

4.Discussions

The research findings confirmed the similar research. There is a significant relationship between Transformational leadership and organizational Culture dimensions (Bass, 1997). Organizational researchers have increasingly emphasized the roles of the transformational leaders on organizational culture. The studies also provide evidence that these concepts have significantly constructive influence for achieving a work climate which has positive effect on increasing employee performance and the supportive relations among them. [5]

A plenty of studies have been conducted in various organizational settings. Some of the empirical results generally support the relations in the same way, but some of them are conflicted. There is not a collective understanding about the associations of these concepts in the literature.

To sum up, one of the most important factors to make a difference under the working conditions of the business environment in 2000's is a committed, productive, highly motivated and innovative human resource. With increase of technological advances and changes, there is need for organizations to address employee satisfaction, organizational commitment, work itself and organizaional culture. The success, survival and competing power of organizations depend on the commitment of their members, supporting their individual developments, ensure their participations, creating an organizational culture and make it stable for a period that all of the members in the organization share the common values and norms and these can be achieved with a leader who has good communication skills, high charisma that is according to Schein (1985). Also, it is important to have a leader who is the source of inspiration and intellectual.

Daft's model (2001) indicates the relationship between leadership, structure, culture and delegation of authority. In this, research the

significant relationship between leadership and culture accords with Daft's model.

Transformational leadership has a significant relationship with learning at organizational learning. Marquardt's system model of learning organization (2002) verifies the relationship of "organizational learning" with "organizational leadership" which belongs to individual aspect of his model. The recent research's results confirm this part of Marquardt's model.

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The Demon Myth in the Epic of Khavaran Nameh

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Abstract: Ibn Hessam Khosfi's Khavaran Nameh, is among the epics that are composed in the ninth century AH, in the form and style of Ferdowsi's Shahnameh. This valuable work includes original and valuable myths, and in this article, the demon is going to be analyzed. The researcher has tried to make the mythical demon's face, its characteristics, and the poet's analysis of the Diwan of the readers clear.
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Keywords: Khavaran Nameh, Shahnameh, myth, the demon, evil and bad, good, and benefaction

1. Introduction

Ibn Hessam composed the Khavaran Nameh, one of the religious epics, in the ninth century AH, in 22500 verses, in the form and style of the Shahnameh. This epopee, similar to other epic works, is the full mirror of heroism and courage. The requisite of an epic work, is not all war and bloodshed, but a complete epic epopee is the one that is the representative of his opinions, and civilization, as well as describing the nation's bravery. Aarne .A and S. Thompson.1973 states that "it is obvious that the world of epic is related to a nation's life, and its basis, is related to a mythical spirit. The myth root is regarded as the emotional, material, and spiritual destiny of a nation. [Aarne. A and S. Thompson. 1973]. The epic is a show of the preliminary life and situation. The motif of this show is a myth. Therefore, the epic is the explanation of the myth, with a symbolic language that is a means to record and register the myths, and whatever preliminary people have believed. One of the beliefs is that we are always faced with the demon myth in epic works. The epic talks about demons, giants, and other wicked, and evil creatures that are always standing against goodness and benefaction. In Khavaran Nameh, the demons, the forces of evil and bad, fight with the forces of benefaction and goodness. In this article, the researcher is going to analyze this evil force (the demon). The storytellers and especially epic composers design the word to show the issues of the world around it, and explaining goodness and badness to the audience, mostly through myth, fiction, and legend, and create a new fiction. Meimanat Mirsadeghi states "the myths are always the source of creation in literature and especially in poems, and its imaginative world, has raised the imagination of many authors and poets, and made them create poems and fictions based on the myths." [Bahar M. 1994]. The myth has an unbroken tie with the myth, Mircea Eliade says, "the narrator's myth is an incident that has happened with the preliminary time" [GOTTHEIL, R. J. H., 1894]. Moreover, the authors believe that "the epic is a report that traces the first and preliminary situation and the issue time of the world". The result that can be achieved from the viewpoints of these two researchers is that the myth is the discovery of preliminaries, and the epic is the explanation of these preliminaries. Alastair Fowle believes that the root of the epic is in the myth. He says: "the myth is similar to a breeding mother that gives born to the myth, and grows it in her arms." [Alastair Fowler.1982] the hero and mythical characters have an active role in the myth, and it even can be stated that mythical events are like the blood in the veins of myth, without which it cannot survive. One of the secrets of astonishment and beauty of Shahnameh and other myths including Khavaran Nameh is these mythical characters such as Fereidon, Zahak, Demon, dragon, etc.

Sarkhosh-Curtis, V.(1993), the famous mythologist, states in the book "Ostoreye Bayane Namadin [The myth of symbolic expression" events and mythical heroes play roles in the myth, then he continues and says, so myth is the first source of mythical motifs…" [Sarkhosh-Curtis, V.(1993)]. Moreover, according to "Marina Warner," Laurence Coupe talks about the value and credit of myth: "the myth shows something, it is a story that is stated for a special aim, it gives a report that is truth, and it mostly talks about imaginary creatures called the monster. The myth shows enemies and foreigners, and it tells us what we are and what we want through imagining them [DESAI, P. B.1908], and the epic does not have any aim except it. Khavaran Nameh includes valuable and worthwhile myths similar to Shahnameh. One of the most significant issues that win the reader's attention in Khavaran Nameh is the myth of the demon. The demons are evil and bad forces that have stood in the hero's way, and caused the dissemination of good, goodness, and virtue.

"Based on the creation myth, after creation the material and numinous world and the amshaspends by Ahura Mazda, Ahriman does not submit, and starts creating the losers and the evil world." Khavaran Nameh, similar to other epic works includes such characteristics as murder, inflame, causing smoke and darkness, becoming dragon, being ugly and clumsy, and one can refer to them very briefly. One of the demons' characteristics is to murder. Some of the demons, are only seeking to destroy the human's generation, and wherever they face with humans, they try to destroy and murder humans without any excuse; when Malek's troops were about to move toward Khavar, they took rest near the meadows, at midnight, the demons cut the heads of five Malek's followers.

As soon as Malek heard the troops roaring
Found out about those waste works
They said in reply, that last night at midnight
Five heads have been cut [Khavaran Nameh, 1st Vol., p. 182]

Another clear characteristic of the demons in Khavaran Nameh is "dispensing" of them. "*Bad* is read as *wata* in Avestan, and as *wad* in the Pahlavi language. Furthermore, it is called *wayu*-(*Hava*) as well. Wayu is one of the most mysterious Aryan gods, and is one of the most mysterious gods of the ancient peoples of the world. He is said to live either in storm clouds, or between ground and sky surrounding in the atmosphere." [Hamidi, 1996: 212]

In the Shahnameh, in the story of *Akvan-e-Div*, the demon's "*bad gashtan"* have been referred several times. Rostam looks for *Akvan-e-Div* in a meadow, and sees him in the form of a wind after three days. [Shahnameh, Vol. 4: 303]. There is a person named *"Roohe-e-Bad"* in a Chinese myth that is completely in front of Ferdowsi's *Akvan-e-Div*. "Fi Lin" a Chinese demon that is known as god's wind, owns a body in the form of a stag in the size of a tiger. He can become wind whenever he likes. J. C. Coyajee believes that *Akvan-e-Div* is much similar to wind in the Chinese myth. He says "the similarity of this myth is such clear that clearly shows the common historical borrowing of two Iranian and Chinese fantasists, and is in the middle with a close relation." The wind-like characteristics of the demons in Khavaran Nameh has found a similar reflection; in the story of Saad who is being captivated by the demons, the demon appears in the form of wind.
At Ali's (PBUH) war with demons, it is written that:

When the oppressive demon, behind the gate
Saw the man who flowed toward the country like the Nile's River
When it saw Ali's cloak,It became the wind to arrive at him [Khavaran Nameh, 188, 1]

The demons of Khavaran appear in many cases in the form of a line, but not with the characteristics of a lion, in fact they are evil and clumsy like the demons, and disappear whenever they are willing to.

A black lion appeared afar
It came roaring toward Heidar
In the meanwhile it disappeared. Heidar looked, but he didn't see it [Khavaran Nameh, 1: 197]

Another characteristic of the demons is that they become dragons, but this characteristic is accompanied with their two characteristics of being disappeared and black. One of the clearest characteristics of the demons in Khavaran Nameh is setting fire, which has been repeated more many times more than any other issue. However, it is interesting that although the demons are dominant on affairs, they do weird things, they are very talented in magician, they appear in different forms, and they disappear whenever they are willing to; despite all these descriptions, humans can dominate on them, captive them, and control. By Khavaran Nameh it is written that. Where did Soleyman go that the demon and elf were obedient by him. Ibn Hessam has talked about *Dal Ibn Dal*'s dominance, the just king, on the demons. From the beginning of the last of the story, Imam Ali (PBUH) is dominant on the demon, dragon, elf, and other issues, and he was the winner in the hardest wars with the demons. Ibn Hessam believes that the demon is the human passions that lead him in bad ways. If a human is able to be dominant on his passion, and control it, he will be the winner in all affairs.

Ibn Hessam says:

The demon of your way is the passion of yours
That is tending to the way of your faults
If you dominate that demon
You will cure all your wounds [Khavaran Nameh, 1: 14]

And the conclusion is that Know the demon as bad people The one who doesn't thank God Everyone who skipped the human's way Regard him as the demon, not as human [Shahnameh, Vol. 4: 304].

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Culture and its role in tourism development

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Abstract: Today, culture has played a crucial role in human life and cultural tourism is the most appropriate way to better understanding of cultural interdependence of nations to each other. Tourism industry is a prism with several sides, each side of which deals with some aspects of life and needs of human communities. Tourism's human – oriented nature has made the role of human beings very remarkable and noticeable in its development. Tourism development can provide opportunities for cultural exchanges among tourists and local people so that the two parties will become more familiar with and will gradually respect each other's culture. Cultural exchanges via tourism will expand the mutual horizons of thoughts, will reduce prejudgment and will bring people closer to each other. Cultural tourism is the most appropriate way to recognize cultural interdependence of nations to each other. The consequences of cultural tourism are the improvement of lifestyle, values, family relationship, attitudes, customs, traditions, behavioral patterns and many more economic and social components. Moreover, it will enhance the awareness of tourists and the host community about the features or the culture and probably historical and cultural commonalities of the nations. It will also create solidarity among peoples and nations in international environment and will connect nations culturally together. This article is aimed to study the role of culture in tourism development.

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1. Introduction

To create a comprehensive and sustainable development and to replace oil resources with new sources of income we need to make use of all facilities and capabilities. In this regard, the development of tourism industry, which is considered by the economists as the third dynamic and growing economic phenomenon after the oil and automobile industry, is introduces as the basic need of the country. Tourism development will improve economy and will reduce poverty (McKercher Bob and Hilary Du Cros.2002). It also has a great impact on income promotion and unemployment reduction and thus will improve people lifestyle and social welfare. Moreover, tourism is a factor of dialogue among cultures and civilizations and it makes the political relations between nations and states more balanced and friendly. Many religions have also emphasized on traveling around the world to get knowledge. So it is absolutely right to conclude that developing tourism industry could be profitable and it can lower the corruption in society and lead to the just distribution of wealth and income . One kind of tourism which can help us in this regard is cultural tourism which can play a valuable role due to its high capabilities. Cultural tourism is a general concept and finding an appropriate framework to define this cultural term is, according to scholars, a little complicated. It has various intangible variables which can be justified on cultural issues , but on social attitudes it is a little difficult to justify it and several researches have been done in this regard each of which clarifies a part of this issue bus doesn't cover the basic principles which everybody has consensus on.

1.1. Review of literature

Tourism is related to human motives, desires and dreams which are derived from culture, to the extent that it could be said tourism main stimulus is, in fact, cultural differences. (Wilson Suzanne. et. al. 2001); and without culture which makes differences, everywhere would be the same and tourism wouldn't be objectified anymore (Byrd Erick.et.al2008). Today, cultural differences have made so many tourists travel all around the world to become familiar with other cultures, gain experience and improve their knowledge. (Hall, C. M.;Lew, A. A. 1998) . More than an economic phenomenon, tourism is considered as a cultural affair around which many cultural monuments are formed. Basically, each tourist represents one culture and they not only introduce one or several behavior and beliefs and or tradition, but also show a live image of one community the other. When cultures are blended, people learn some cultural characteristics from other cultures and some from their own (Singh, L. K. (2008). In terms of culture, tourism makes the development of regional cultures, public arts and treasures possible. It contributes in rescuing all cultural values which precisely have tourism value.

At present, there is a bilateral relationship between culture and tourism. Culture is considered as a crucial source of tourism development, and tourism contributes to cultural development as well. Culture and cultural attractions provides motives for tourists and tourism, by creating wealth and employment for local communities, becomes a strong incentive for the preservation and revival of local and traditional cultures and for the vitality of the cultures. Culture attains its life and dynamism via interaction with the environment and encounter with other cultures. Cultures which are enclosed and limited to specific social atmosphere will lose their cultural value and growth, and will be gradually ruined (Ritchie, J. R. Brent ;(2011). In today's world the limiting factors of interaction and communication among the cultures are gradually vanishing and cultural relations are constantly expanding. In such atmosphere, cultures are forced to know and deal with each other. In other words, in such atmosphere, there is no place for cultural comfort, security and stability which existed in the pat closes environments, and culture must have a dynamic presence in the domain of cultural relations (Theobald, William F. (1998). Tourism develops cultural relations. Revival of traditional ceremonies in all countries around the world for attracting tourists is one of the strategies to develop cultural tourism. Many tourists are interested in visiting and attending cultural events and ceremonies and thus they plan their trip so that it could be simultaneous with such rituals and ceremonies .Tourism helps to restore traditional values and rituals.

2.1. Cultural tourism

"Farhang" (culture) is a Persian term composed of two parts "far" and "hang". "Far" is a prefix which means "front, up, glory , dignity , and advance". "Hang" is derived from Avestan root "ang" meaning "draw, plan and intend". "Kultur" and "Culture" are derived from the root "Culture" meaning "inhabit, cultivate, protect, and breed". Culture is a set of structures and spiritual and material treasures of specific ethnic group or nation. Throughout history, different movements have offered various definitions of culture. One definition of culture by UNESCO is as: "Culture is a complicated set of behavioral, intellectual, material and spiritual characteristics which represent a society or a social group. This includes not only arts and literature, but also life forms, type of construction, rights and laws, beliefs and values. "Culture is the foundation of civilization. But these two are different in all aspects. Civilization represents residence and stability, while culture represents movement and development. Civilization appears in courts and castles with armed guards, while culture appears in solidarity and interdependence and social life. Civilization keeps the concept in mind, but culture keeps the meaning of liberty in minds. Culture will wither in isolation and won't develop anymore. Culture is a clear manifestation of social life and social life lies in the relations of human beings. The more the human's communications, the better the creation and development of the culture. Culture can be defined as a set of ideas, beliefs, values, knowledge and behaviors that makes up the common base of all social behaviors. Culture underlies all actions and features of life. It is culture that largely determines how a country should act (Din, K. H. (1997)). In fact, a set of human achievements to overcome nature is called nature. This set has developed by the relations among people on one hand, and has developed relations within it, on the other hand. Intercultural relations are the relations among peoples who have created and protected various cultures over time. Culture is the basic factor for a society development. Man is not just a component of his country's culture in every condition, but a unique, necessary, and irreplaceable element of it. Anthropologists have identified three aspects of culture:

First, culture is not instinctive but acquired. Second, different aspects of culture are interdependent. Third, different cultural groups are common in one certain thing and culture identifies its limits and boundaries. It's very important for each community to get along with its exclusive cultural pattern. Culture has many visible manifestations which people might be aware of, but is also had many hidden forms. The problem is to make these hidden forms explicit. Cultural tourism encourages recognition of visible and invisible elements of cultural heritage.

Cultural tourism encourages individuals and communities to get involved with tourism and to study their origins and history and its evolution and it also forces them to define their future goals. Cultural heritage is a living instrument which must show us our own images and ideas. This heritage will enable us to continue to develop our land and will set our lives in accordance with our predecessors' authenticity. It contains the necessary elements for developing cultural tourism in the community. Cultural tourism development requires familiarity with the concepts, knowledge, dimensions and different approaches. Domain of cultural tourism development is interdisciplinary and benefits from a holistic and systematic approach (Britton, S. G. (1991). When examining the behavior of human and society, the cultural dimensions are very important. Cultural dimensions are also important in international environment because there are certain

cultural differences between countries. The concept of cultural perspective encompasses the geographical patterns of human-learned behaviors. These patterns, within the framework of transmitting ideas and myths and imagines from generation to generation or from one group to another, form the cultural perspective at any geographical environment based on the heritage and mental, social and technical facts (Goeldner, C. R.et.al.2000). Cultural perspective reflects the environment adaptation of local knowledge, including the notions that appear within intergeneration imagination, and is about new ways of thinking and understanding the world. Therefore, cultural perspective encompasses several layers of cultural levels. While globalization is growing, maintaining and sustaining local cultural landscapes requires introduction and advertisement. That is we should think globally and act regionally and locally and while respecting the global laws, we should care about local and indigenous cultures, too. Moreover, logical and material, intellectual and emotional access to cultural development is both a right and a privilege. Therefore, knowing other cultures and their heritage has become necessary. This is parallel to developing strategies toward the economic approaches of culture and has formed the cultural tourism in relation to cultural and economic needs (Mathieson, A. and Wall, G. (1982). In conceptual term, cultural tourism has been defined as human's traveling and leaving his typical place of residence to visit cultural attractions and to gain new information and experiences for satisfying his cultural needs. Technically, cultural tourism involves people's traveling to see particular cultural attractions such as cultural heritage sites, aesthetic and cultural values, arts and plays, which are located outside of their normal place of residence(Milne, S. and Ateljevic, I. (2001). Based on these definitions, cultural tourism includes visiting cultural attractions such as historic museums of fine arts and architecture, cultural customs and traditions, and other cultural aspects. In a new approach, tourism is considered as a cross-cultural communication. This attitude might be followed by issues which are very important in policy making and planning in this area. Cultural tourism formation in one region depends on cultural provision and offering of the existing attractions , local and regional support of cultural tourism in concept of social and organizational structure and also the existence of cultural and natural attractions blended together and the formation of cultural perspectives. Therefore the formation of such tourism together with improving local resident's awareness about the advantages and disadvantages of cultural tourism could be useful. Supporting the cultural heritage and providing the necessary conditions for keeping the regional population is another requirement (Dogan, H. (1989). Cultural tourism has existed in mankind world as a cross-cultural communication and has had many effects on establishment and development of civilizations. It has the possibility to develop everywhere, because all regions have their own culture. UNESCO has introduced it as one of the elements of the World cultural heritage protection. European Commission supports it as a major industry and in many parts of the world calls it as a vital tool for economic support of local activities and customs and traditions. Accepting this point can be followed by a logical conclusion which is the necessity of defining and classifying tourist again and this time based on its cross-cultural features. In this case, other types of cross-cultural communications which are common with it in subject, methodology, and policy, will be covered by this definition. This attitude can consider tourism as a cross-cultural communication prior to a recent economic activity. With remarkable cultural and communicational features like other intercultural communications, a divine status will appear which always has accompanied human being from the beginning of life on Earth. In a general approach and its importance in the tourism and the method of cultural exchange and cooperation in tourism issues, with the release of the 1980 Manila's declaration in General Assembly meetings, World Tourism Organization (WTO) was basically paid attention to. This statement counted on positive cultural and social impacts of domestic and international tourism; it also asked the governments to try to preserve cultural resources, so that continuous use of them will not ruin them. In 1982, Tourism Organization General Assembly paid more detailed attention to the principles of Manil's statement and thus Acapulco document was released.

3.1. Theoretical Foundations of Cultural Tourism

Some believe that tourism growth and development and its conversion to an organized industry, will develop people's culture spiritually and materially. The development of industries and specialized services such as marketing techniques, flight services and transportation, will be specially followed by the development of small industries. Also tourism growth and development will reduce conflicts and will increase innovations and development in communities. Tourism will contribute to better comprehension of the world various cultures and cultural development. Based on this approach, tourism development is a path to cultural interaction and communication among different nations and tribes which, in turn, leads to cultural development and, economic and social growth in contrast, opponents of this group believe that with the arrival of tourists, cultural challenges

will increase. They believe that tourist expects more comfort from the host community on his vacation which will have social and cultural destructive effects on the host; for example it causes conformity and will ruin community's sacred rites and values and beliefs.
In 2002, in a research in this case, Rats Tamara believed that the most important effect of cultural interaction between tourist and the host family was the imitation of tourist's behavior by local people. The consequences of such imitative behavior are changes in the use of language, dress, and culture and also contribution to increasing social chaos and corruption such prostitution and gambling and changes in material and non-material forms of local culture. Poor cultures often are easily influenced by tourists' cultures and get whatever good or bad from them and will gradually vanish. But tourism interactions among communities which have many cultural commonalities will lead to fewer damages. In other words, tourism development opponents' point of view about countries with lots of cultural commonality is not acceptable, because negative social and cultural effects of tourism are the result of poor planning and management. If tourism is managed with appropriate planning and management, its destructive effects are very small and insignificant. On the other hand , cultural commonality has creative and spontaneous elements and a powerful foundation so that if it is well planned and implemented , while keeping its own identity and integrity , can take advantage of the features of other cultures and develop proper cross-cultural planning and management through updating issues.

4.1. Principles and Charter of Cultural Tourism

In 1999, The International Council of Monuments and Sites (ICOMAS) passed the principles of cultural tourism charter in Mexico. This charter is composed of six main principles:
1. Since domestic and international tourism is one of the most important means of cultural exchange, its conservation should provide opportunities for members of the host community and visitors to primarily experience and understand the culture and heritage of that community.
2. In order to achieve a sustainable future for cultural heritage and tourism, the dynamic relationship between these two must be managed.
3. Tourism security and planning for heritage sites must guarantee that the visitors' experiences would be valuable, satisfactory and enjoyable.
4. Host communities and indigenous people should be involved in planning conservation and tourism.
5. Tourism and conservation activities should be profitable for the host community.
6. Tourism developing programs should support and promote the features of cultural heritage.

5.1. Cultural tourism motivation

Although in this thesis it is attempted to introduce tourism as a cross-cultural communication, it does not necessarily mean that tourists in their tours are just motivated to understand other cultures. On the other hand, it means that this activity is conducted with different incentives, and it is a cross-cultural communication in essence, based on which studying and policy making must be done. However, in any communication, different motivations and goals can be defined. In a primary classification , we can distinguish between the tourists' motives and goals on one hand , and the reasons or interests upon which a country develops tourist attraction , i.e. the hosts ' goals , on the other hand. Usually tourist attraction is done to achieve two main goals: first, to earn income and to create economic prosperity which was mentioned earlier and which is the main policy of most tourist countries for attracting tourists. But if we have a cultural look at tourism, cultural goals will be the main policy of tourism. These goals might include promoting cross-cultural relations among people, demonstrating solidarity in different levels, introducing domestic culture and or expanding it all around the world. Cultural attractions have more diversity, since human being has interfered in creating them, and also due to various human cultures. These attractions can be divided in 7 main groups:
1. Historical and cultural attractions, such as monuments and museums;
2. Religious attractions, such as mosques, holy places, Imams' shrines, which are also placed in historical attractions from another perspective.
3. Social attractions, such as public culture and governments' characteristics.
4. Demographic and folkloric attractions, such as cultural ceremonies and traditions of various ethnic groups.
5. Technological attractions, such as tall buildings and innovations displayed in various exhibitions.
6. Research and educational attractions, such as famous universities and libraries.
7. Sports attractions, like stadiums and sports events such as Olympic Games.
But if we want to examine cultural tourism more professionally, we must know its components. The typology of cultural tourism attractions is classified into eight main element including : Archeological , historical, and cultural sites and certain cultural patterns , arts and crafts, attractive economic activities , attractive urban places , museums , festivals and cultural events and finally hospitality customs and traditions of residents. Each of these attractions has its own characteristics.

2. Discussions

Tourism is one of the best ways to access historical and cultural experiences of societies. Through traveling we can closely recognize the factors of progress and decline among nations and societies. By visiting historical monuments and landmarks in tours, such as urban ruins and cultural heritage in museums, we can closely comprehend wonderful and excellent experiences of nations and their fall and collapse. Developing tourism industry and attracting tourists in every society, makes it possible to introduce the historical and cultural sites of that society and leads to its cultural growth and development. In other words, the cultural strengths and weaknesses become more obvious which ultimately leads to the Cultural Revolution and development. If the culture of societies is rich, tourism will blend ideas, cultures and civilizations together and makes a whole in which each component, while maintaining its own independency, will have an inseparable relation with other components. In fact, one of the most significant results of cultural tourism is preservation of historical and cultural monuments. Moreover, development of handicrafts and local products, preservation of local values, and growth and development of employment are some other consequences of tourism growth and development. Nowadays, many countries with rich cultural background, have contributed to their local and national cultural growth and development through the rehabilitation and restoration of ancient structures of historic cities. Moreover, tourism revenue provides the chance to preserve historical and cultural centers, to attract more tourists and to keep historical and cultural monuments dynamic.

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Obstacles to localizing and institutionalizing Politics

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Abstract: Politics as a new science and an academic and methodical discipline in Iran is not more than 100 years old. There is a gap between politics and political society in Iran and these two are not linked together. In other words, politics in Iran is not the one which is associated with social framework and political system of Iran. In this circumstance, politics is faced with some problems and obstacles and won't get the necessary conditions or space to grow and develop. Moreover, politics won't move ahead, but in many ways will get a retrograde step. Finding a solution to this problem is only possible by the identification and clarification of the existing barriers and by critical evaluation of its status and solutions. This article is aimed to explain some existing barriers to the formation and development of politics in Iran, and to achieve this goal it will refer to Bikoparkh's approach in expressing the identity and the whys of institutionalized politics in some societies , and its lack of formation in the others.

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Keywords: political science, research traditions, BikoParkh ideology

1. Introduction

Politics is a very complicated and ambiguous concept in the field of humanities and has always been noticed in the history of human thought. In classifying sciences into theoretical and applied, Aristotle places politics in applied sciences beside ethics and home counseling. In consistency with Greek classical thought and in modern and contemporary discourses and why of this concept has always been a controversial issue in the philosophy of West. Like other modern sciences specially the humanities, this science has not been productive, efficient, and effective, and is still unproductive, In Iran due to different reasons such as lack of coordination with power structure, lack of political research tradition, and not being native. Although in Iranian-Islamic tradition, from Iranshahri thoughts to those of Islamic philosophers, Politics has been noticed and emphasized besides other concepts, this article is aimed to investigate and study this concept as an independent subject and within an intellectual framework, separate and independent from tradition. This matter can be studied from different points of view and with regard to different approaches , thus this article tries to investigate the reasons of the lack of formation of politics as a modern science in non-western civilizations (Iran) and based on BikoParch approach in its explanation. In other words, why, unlike developed countries, in some other countries (like Iran), this science has not been institutionalized, and has been unable to appear as a dominant discourse to affect the current condition.

1.1. Biko Parch's approach to political science

When Hobbes founded modern political science by writing his classical book, he mentioned the main objective of this knowledge as the establishment of civil peace and the citizens' comfort. Although during the past four centuries after his claim , western societies have experienced lots of political abnormalities , it could be surely said that political knowledge in institutionalized societies , raised certain questions , which became the origin of the formation of some new rules and regulations which itself made a perfect form of social life. Hhowever, political knowledge was unable to be institutionalized in all civilizations, to raise certain questions, and to form a perfect way of social life. There are different approaches in relation to the reason of this politics lack of institutionalization in various civilizations including Biko Parch approach. Biko Parch began its work in political philosophy with a fundamental and historical question which was why political philosophy develops in some civilizations but does not in the others and constantly declines there. He views the western tradition of political philosophy with a philosophical look and basically looks at political philosophy from a philosophical perspective (Lane, Ruth (1996)). Political philosophy is one of the most ancient kinds of probes dealing with major issues of social life. Parch believes that although political philosophy has emerged in critical circumstances, crisis is not necessarily its condition. There are many cases in which no certain political philosophy has emerged in critical situation; on the other hand, in some circumstances, political philosophy has flourished without any crisis or conflict. Parch himself referred to some conditions which he thought were necessary

for political philosophy and discussed them with reference to the history experiences(Stoner, J. R. 2008). First: There must exist politics, the main subject of political philosophy, in a clear way which is easily recognized so that politics raises its own questions to draw attentions and theoretical knowledge towards itself and to care about a systematic philosophical research about it. Second, society must have developed political research more than political knowledge as a systematic discipline. Political sciences can be realized when the issues which are raised in the natural trend of political life are changed into philosophical form and are introduced again as philosophical issues. Third: There must be a connection between political life and philosophical research; political philosophy is raised only when politics and philosophy are interrelated, i.e. when the issues and problems of political life require philosophical research and when philosophy is interested in them and is capable of dealing with them. Fourth, having the atmosphere of tolerance and freedom of intellectual exchanges. A political scientist cannot tell in advance what results his studies will produce for political life. They might be willing to criticize or even to overturn the established order, and raise some questions about the dominant beliefs and behaviors, anyway. Parch distinguishes what a political philosopher does from what the political philosophy does. "A political philosopher might do historical or sociological research and so on , to realize his philosophical goals , but the fact that political philosophers are conducting these various researches , doesn't make all these researches necessarily philosophical." (Hampton, Jean (1997)). Philosophy is ultimately formed by means of certain inferences drawn from the nature of politics and philosophy and their relationship. New inferences from philosophy and also developments in political, economical, social areas and so on, have generated new methods of relationship between politics and philosophy which a political philosopher couldn't ignore; but none of those mentioned challenges which were, in some way, in favor of separation of radical and traditional political philosophy, were able to disrupt the continuity of that tradition According to Barens, Ingo, ed. (2004), a political philosopher is not abstracted or floated in a historical. vacuum, but is an individual existing in surrounded place and time. Human mind is a complex whole in which the intellect, lusts and desires are all intertwined. Hence, it can not be divided into separate parts, so that each part is able to do its tasks by itself separate from other components. Thinking is not a process not solely related to the brain and mind, but it is quite a human existence. It is not the mind or the wisdom, but the human existence which thinks, meditates, and gives reasons. Social assumptions or social affairs are the means of recognizing philosophers from their under-study assumptions. A political philosopher is not a single and transcendental entity which is never contingent due to his social existence. A political philosopher cannot claim credit and life for something which is inherently limited to time and pace (Blattberg, Charles. 2009). Therefore, political philosophy is not a single unlimited matter and free from sociable and historical man. Concepts such as freedom, equality, justice, community, patriotism, loyalty, commitment, authority, power and responsibility are all defined in different forms in various societies and cultures and there will be a relationship between them. Certainly, no political philosopher is able to escape from his society entirely. The society of a philosopher constantly affects his knowledge and makes the reference point of his studies (Angell, Alan.et.al.2001). Barens, Ingo, ed. (2004), with reference to intellectual and critical properties of Western political philosophy, refers to the challenges which lie in front of it: 1. the effect of hidden assumptions on thought through the life conditions and experiences. 2. Tendency towards public rights in spite of existing variety in the real world and cultural differences. 3. Subject reticulum property dominating Western thought since 16 C and contemporary challenges in front of it. 4. The current situation that globalization process has made for political questions (Thompson. Cf. John B.1984). After a brief explanation of Parch approach, the application and use of the conditions of assumed political knowledge will be elaborately explained in his model.

1.1.1. There must exist politics, Philosophy major subject, for society in a fairly clear form to be easily recognized.

Politics has been one of the Greeks' innovations. Tight relationship between politics and philosophy was formed in Greece. Politics cannot be formed in a legendary cultural community, as a vast area of myth, religion and philosophy, that is, intellectual thought uncommitted to religions and myths. The collapse of Mocnai system in Greece provided the necessary conditions for the formation of politics; in other words, it was in this era that Police (Polis) was developed as political reunion of free and equal people, and or the concept of city and citizenship and rational thought was formed (John C. Bock. *1991*). Rational thought, which in turn created political system and rational governmental pattern, was primarily raised on the clear issues of government and cities. This means that government and cities which were moving from a national mythical world to a philosophical world, raised clear

and non-mythical issues and this new generated atmosphere became the basis and foundation of political questions which in turn draw the political looks towards itself. But in the system previous to government-city , that the issues were hidden in the ambiguity of myths , they couldn't draw theoretical – political attentions towards themselves; Therefore , a society which is still surrounded by an aureole of myths and ideology , and political transparency and political issues are delayed and not expressed explicitly in it , cannot draw political looks towards itself in its exact scientific and philosophical meaning and cannot develop rational political models. Considering this explanation, Iranian society, as well, was not capable of raising political issues clearly in occurrence of political events in its past history, mainly due to the lack formation of political atmosphere and rational thoughts, and because of dominant ideological thoughts. Therefore, political sciences cannot achieve their clear and recognizable political goals in the context of such a society which is dealing with not only the problems of traditional structure, as mentioned above, but also the problems of premature modernity. About the disadvantages of premature modernity in formation of opaque and ambiguous political issues, we can refer to a situation which is called cultural schizophrenia by Kain, Philip J. (1993). He believes that such situation in traditional countries is due to the fact that the authors of these countries are placed between two paradigms or between two classifications of knowledge. They have separated from tradition or in better sense, are in ignorance towards tradition without the ability to be bond with the idea of modernity (Kain, Philip J. (1993)). So , as mentioned in introduction , theories are the reflection of future " issues" they deal with , and their accuracy and scientific validity depend largely on the matters' and issues' being clear, recognizable , and unambiguous which are studied by them. Objectivity and clarity of the subjects in the area of technical and natural sciences, is the origin of their scientific validity and strength. What makes the studied subjects in humanities valid and objective is their clarity and recognition in a non –ideological atmosphere. Political issues and ideology are closely intertwined in countries that are politically underdeveloped countries. This intertwining of political issues, which is the subject of politics, and ideology, will cease their objectivity and clarity. Lack of clarity and objectivity of political issues in general and particularly in underdeveloped countries have caused the field of politics to vanish and political theories not to develop; therefore, since there is a gap between the realities of Iranian political life and the superficial and strict contents of politics, it could be said that politics is faced with a critical condition in Iran because it doesn't respond to social realities. Crisis appears whenever a science or a phenomenon cannot perform its particular tasks. Therefore, since there is a gap between politics and political issues of Iran, and they are not intertwined, it could be said that politics is in a critical situation. So, the authors approach, which states that the formation and power of politics depends on clarity and excellence of political issues in the universality of political and social tradition, indicates that the weakness of political science in countries like Iran, is due to the lack of clarity and the declining level of political issues (Leonard Shihlien ,Hsü. (2005)).

2.1.1. Society must develop the tradition of political research earlier than political science as a systematic discipline.

Political research and analysis is a feedback which can and should review the functioning of the political system of society and realistically and clearly show the dynamic field of politics in society. Thus, by research and analysis of political and social issues, it is meant that each scholar or researcher, regardless of their dignity , political , social and cultural status and power , must be permitted to say and write whatever he thinks of and evaluates without any concern or fear of improper or violated reactions by the government or any official or unofficial groups. Moreover , there are various problems in terms of political and social research in Iran , including the followings: first: lack of research in Iranian society is due to not paying attention to cognition and methodology in various branches of humanities , and theorizing and theoretical analysis have a few fans among scholars and researchers (Castiglion Dario and Iain Hampsher-Monk.2001). Second, executives who are often educated in modern sciences, think that they don't need any help in fairly any affairs, and consultation and team work is very weak and rare in management and ruling the country. Third, there isn't a clear comprehension of the method and the significance of social, political, and economic research among the political and economic elites and ordinary people. In a community with such rich cultural values and respects for spiritual beliefs, emphasizing or relying on objective methods of temporary world is not very attractive and there is little respect for social researching. Relying on the approach and methodology is one of the most remarkable features of modern science. Since traditional knowledge and cognition in Iran is still greatly respected, the principles of modern thinking and their related methods cannot develop there. However, one of the major faults of politics in Iran is its foreign, non-native nature (Andrew, stark). Considering the time and the age of political research

history, it should be said that the school of political sciences was established in Iran 100 years ago and politics entered Iran since that time. The quality and quantity of this period of time in forming and influencing political research in Iran can be divided into four periods: 1. Since the establishment of the school of political sciences to the establishment of Tehran University; 2. From the establishment of Tehran University to 1961; 3. From 1960s to the Islamic Revolution of Iran and the beginning of cultural revolution; 4. From the reopening of universities after cultural revolution to the present. Studying the CV of politics scholars in these periods of time and the development of this science , specially the events and occurrences at universities after the Islamic revolution of Iran and cultural revolution, is very appropriate and necessary for evaluation the current status and future trends. Studies have been done in this field which are worthy of appreciation, but not enough at all. With the evolution of teaching humanities, some measures were taken to develop research activities in political science, but it seems that teaching politics is preferred to doing research about it (Browne, Ken. (1992)). In addition, it's necessary to be noted that politics problems in Iran, in many cases, are not just specific to politics itself. ; In a broader look, most branches of social sciences are in similar conditions (Bilton, Tony et al. (1987)). Political science, in true sense of this term, must be a science which is developed through applying the most recent knowledge of man at present and based on the recognition of political and economic features of Iranian society and must guide political deeds. Hence, according to Larry Diamond, the role of political science in the world is to face with these challenges and to change its priorities and curriculum trends. He believes that political science is responsible for understanding and recognizing issues and phenomena and trying to find answers and solutions for them (Stark, 2002: 5**).** One of the criticisms of political science faculties and political scientists in Iran is the decrease of their role in daily life particularly in the culture of Iranian citizenship. This role is played by the media and the press and researches and studies that might be able to inform people, without any academic analysis which might be incomprehensible to ordinary people. Given the importance of this issue it can be said that most of politics scientists, in countries like Iran are not popular thinkers (Diamond, 2001). And the role of professors and researchers of politics in terms of public culture has paled into insignificance. In this regard , it can be referred to Jonathan Cohen's opinion that believes the reason why politics scientist , especially in certain countries mentioned above , weren't able to become popular thinkers and scholars lies in the methods and approaches they have applied in their studies and in the fact that they have drowned in obscure theoretical aspects which are difficult for ordinary readers to comprehend and which ruin their values and benefits for the readers and even for the politicians ,themselves. As a result, political science currently offers products which, at least in appearance, have few applications in the real world of politicians, bureaucrats and citizens and other unions of Iranian political society. If it is possible to compare the role of politics scientists in public culture of citizens with the role of sociologists and economists, it can be said that the latter group's activities are more than those of politics scientists. Specially those who have just theoretical and academic tendencies have confined themselves to political science faculties and have separated from others. Unlike professors of social sciences, economy, and psychology, professors of political sciences write fewer materials for public audiences and ordinary people (Rutner, Maryam.2010). Of course this issue has not been ignored by many professors of political sciences and has been referred to several times. Rutner, Maryam 2010 believes that we don't know in what social relations in Iran, politics is formed and how the action and reaction between people and the power of government is. Politics competence in Iran is not scientific since neither is the subject of politics clear nor we can do anything to understand that subject. Those political sciences in real sense are still in early stages in Iran and have a long way ahead to maturity and productivity. Achieving this goal not only requires scientific premises and equipments, but also the conflict of ideas and opinions and a patient spirit and tolerance of beliefs and ideas opposite to conventions.

3.1.1. Relationship between political life and philosophical inquiry

The relationship between objectivity and subjectivity is one of the major relationships in the field of political philosophy, especially in modern thoughts, but subjectivity is formed in various ways in discourses of political thoughts. What is emphasized in this article in terms of the relationship between subjectivity and objectivity or between philosophy or political life is that crisis is the origin of dynamic philosophy and political thought; As Gheissari Ali. States, at first step a philosopher is faced with political crisis in society and if this crisis actually owns the required political capacities, it will draw the philosophy looks towards itself. In other words, crisis must be the origin of philosophy

formation, which is not, in fact, one way; philosophy capacities also must be such that they can attend the whys and wherefores of critical issues and raise their serious questions about the whys of those issues. (Gheissari Ali.2009). Establishing such serious relationship between philosopher's subjectivity and political issues will remove any suspicion and will substitute knowledge for it. It is in such relationships that philosophy can be directed towards the perfection of society, and political crisis can be the origin of the formation of questions and thoughts in philosopher's mind. Common forms of political life and philosophical research must face each other and be able to communicate with each other. A community might have well- organized political life and rich philosophical traditions but these two might be separate from each other. In this case, if political life moves easily and doesn't raise major issues so that the philosophers will have to think carefully about them and try to solve them, then the political philosophy will not be formed. Gheissari Ali. Believes that developed countries will make a logical and rational coalition between political thought and deed which has a significant role in the growth and development of science. If the capacity and capability of current political issues is mundane, it can't appeal to the philosopher, and if the crisis is a serious problem, it will attract the serious attention of philosophical and scientific policy to itself and provides the background and the context of requirement for scientific and philosophical approach to policy. The more complicated and the more serious is the identity of political issues , the more complicated the structure of a philosopher's mind will be and an organized philosophical system will be formed; but if political issues in society have a mundane status , it will descend philosophy to the same position. The relationship between political life and philosophical research, is a dialectic one and with internal connection. Many of the recent political researches, have just raised one of these subjects and think of the others as the effect and the result of it. In this regard, Gheissari Ali.2009 knows the intellectual and philosophical decline as the origin of political decline, from which the superiority of political thought and science to political structure can be concluded therefore, it could be said that one reason for the lack of political discourse in Iran is the nature and capability of political issues and crises. Crises which happen in a trivial and altered level and political performers in these crises will also alter, as required and under ideological atmosphere and vague and opaque political traditions. As a result, political thought which has a dialectic relationship with these crises, can't be away from this alteration, and this is one reason of lack of formation of political sciences as the dominant political discourse in Iran.

4.1. Atmosphere of tolerance and freedom of intellectual exchanges

Politics life depends on its critical attitude and this is the only way it can play and effective and reformist role in society. However, the lack of open political atmosphere has made politics follow the government; moreover, the culture of Iranian society and the modernity of university graduates has separated politics and government from society. It must be said that policy in Iran, both domestic and foreign, is not basically scientific. It means the neglect of political sciences and the uselessness of their researches. There is a wide gap between politicians and political pundits, in terms of their world-view, attitudes, goals and intellectual principles. Today, the attitude of political elites in Iran is a philosophical one and based on non-interpretive hypotheses which are not affected by the scientific findings at all. Therefore politics researches cannot actually offer a solution to politicians since they ignore such solutions. At first and at the beginning of its development in Iran in 1898 (solar year) and with the establishment of the school of political sciences, politics was following a certain practical goal. School founders intended to teach the common knowledge of that time in the fields of policy, economy and law. They tried to make the students familiar with international events and development and to train knowledgeable and efficient workforce to be employed in the ministry of foreign affairs. Thus, this school was formally a section of Foreign affairs ministry until 1926, and the contents of its courses were mostly about foreign policy, teaching modern diplomacy, and international law. Then the school of political sciences gradually became the center of liberal thoughts and its teachers and students were later famous constitutionalists and played major roles in the development of this period. This matter indicates that the school, within a natural trend, was involved in political and social life of that time and provided the background for reflection on domestic policy affairs, but it didn't last a long time and was stopped by the 1299 coup and Rezakhan's coming to power (Gheissari Ali.2009). Along with this change, and with emphasis on knowledge and power relations, Pahlavi dynasty was a continuation of the same authoritative and patrimony system with authoritarian and despotic nature which was simultaneous with the formation of political sciences in Iran. In such conditions, political sciences didn't have a chance to find any space to grow and to become efficient. After that, Iranian political researchers had a conservative attitude towards

Iranian political changes and weren't allowed to critically study politics and government in Iran. Politics is strongly willing to criticize the power and the current situation and thus opposition to it will increase and its graduates are looked upon with disfavor by the ruling governments. Politics and its students must try to remove charges against them while reviewing government performance. Politics must be a mean, for directing and correcting misunderstandings and foolish deeds, and for modifying unreasonable decisions which are incompatible with national interests.

2. Discussions

In this article it is tried to briefly investigate the problems of political science in Iranian society and the factors affecting it. Due to the political culture left by centuries of despotic governing in Iran, political science has failed to take advantage of political atmosphere and scientific criticism sufficiently. It is obvious that this science, in its real sense, is still in introductory steps in Iran and has a long way ahead to become experienced and productive. It needs a fundamental and continuous attempt to develop profound political knowledge using the most recent human knowledge and based on political and economic characteristics of Iranian society. In order for politics to be scientifically and practically dynamic , there is no doubt that we must avoid absolute orientation , on one hand , to remove barriers , and we must avoid giving and offering absolutely subjective and non-rational answers and solutions for we are dealing with humanities and politics as the most sensitive ones. Politics can have an impressive and determining role in Iranian society if and only when it responds to public, national and international challenges properly and in accordance with time and place condition. Moreover , it must be able to raise certain questions which represent specific values and form a perfect social life ; political science , must also identify different threats and their causes and the way of fighting with them and preventing them , by presenting a realistic political analysis of political issues and phenomena. Achieving this goal not only requires scientific premises and equipments, but also the conflicts of ideas and opinions and a patient spirit and tolerance of beliefs and ideas opposite to conventions. Since some civil concepts and subjects such as endurance , tolerance of different ideas and opinions , respect for others' ideas and votes , are new in our society and it's not more than half a century that respecting other people's votes and ideas , tolerating various attitudes , and offering different approaches to social and political issues in Iran have been raised. Therefore, the issues of Iran are advancing in a revolutionary course, and the events that occur in the country, are moving ahead in a linear progression. Consequently, it could be said that the future of political science in Iran is in a linear progression towards revolution and dynamics

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Gas management in future

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Abstract: Oil prepares industries fuel in centuries as a cheap energy resource. This great resource has been decreased today and has been created worrying results in economical development of industrial societies. This problem also threatens lesser developed societies that try to reach economical index growth like west developed countries. according to presented subjects about resources and raw oil political future and by surveying charts and predicting oil and gas consumption in future and decreasing in consumption predicts and considerable growth of gas and oil consumption productions in future and according to creating new polar in economic era and high consumption of energy in them and tangible changes in energy consumption procedure of oil to other byproducts and especially gas , it is clear that inclination to financing volume degree of oil to gas isn't out of expectation.
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1. Introduction

Oil is black gold that has main role in world economic and may be all of commotions in world are because of oil and for oil. Oil prepares industries fuel as a cheap energy resource in centuries. This great energy resource has been decreased today and also has been created results in economical development background of industrial societies. This problem has been threatened even lesser developed societies that try to reach economical index growth like west developed countries. So, we should know that this oil will finish one day and we should think about cheap and suitable replacement for it.

This reality (sudden oil price growth) creates considerable barriers in preventing of equalizing economical development in lesser developed. Preparing needed resources of raw oil and trusted presentation of it in suitable prices, makes possible interactions between cultures and this affair can cause creating superpowers and new era of human culture. in this era , gas has important and redoubtable place and producers countries have more suitable conditions . Iran is second country that has gas resources in world after Russia (Ivanhoe. F. 1995).

Today , Producing full gas of gas resources in first years after Islamic revolution shows considerable increasing growth procedure , when we survey past , we see that cubic meter millions of oil wasted beside exerted oil from ground , because of correct and sympathetic non management and not being enough facilities . That in addition to wastes national asset threatens human being living and other micro organisms, but today, six hundred million cube meters is produced daily(Campbell, Colin.1997) . And in future producing national asset will have more suitable condition. And according to situation that Iran will have in energy consumption in world future, gas is the most important replacement for changing energy base and Iran is one of countries that have great steps in this subject.

1.1. Oil price frequencies changes because of not using of energies

We are in a considerable era of preparing oil resources and its prices. Mr. triner (1997) predicted continually oil increased oil price because of oil shortage after (2000) Gregorian year. in fact , in march (2008) Gregorian year oil price increased after psychological operations to (100) dollar border and then increased up to (140) dollar in June . as OPEC organization master alarmed probability of oil price increase up to (200) dollar . valley miller , huge energy company's master in world (proem gas) predicted that oil price will increase up to (250) dollar and reached up to (300) dollar and in longer duration , (380) dollar price was predicted . In predicted time, oil price reached from 147 dollar in 11 July to 115 dollar in august, it means that 22 percent price decline was one of main downfalls between (2000 to 2008) Gregorian years. Albeit according to that 10 to 31 percent downfall was predicted. This downfall wasn't unexpected, but most of expert's retreat of their positions and promised oil prices dickers decline. In table1, according to oil yearly divisions' tables, has been shown the highest and the lowest oil prices between 1984 to July 2008 Gregorian years. Oil suddenly price increase, in third millennium and from 2002 to July 2008 Gregorian years is seen with high increase to 539 percent in price (OPEC News Agency.2009).

Table1: average of the highest and the lowest price in dollar unit in every year

year	1984	1988	1990	1994	1996	1998	2000	2002	2008	2008
prices	28	15	23	16	20	12	27	23	147	115
changes	---	-46	53	-30	25	-40	125	-15	539	22-

Also, oil price frequencies could predict according to hiraj viewpoint and last viewpoints in duration that world was reached to maximum oil production or near it. Anyway, these frequencies are because of oil resource declines.In this research, we survey causes and reasons of total increase in raw oil price, and also survey its influences on energy base changes and then procedure change of oil consumption to other energy resources (changing energy base) especially gas has been shown by presenting different predictions in production procedure and raw oil consumption to 2030 Gregorian year. More and cheap resources of oil has been the main agent in industrial wonderful production in Arab countries and America in last one hundred years, this is while oil abundant resources has short life. According to Herbert and bell chart, development of oil was in 1970 Gregorian year in United States of America. In November 1997, IEA hold a conference in Paris and presented a thesis that was about oil exhaustion. and result of this conference was a thesis for G8 masters meeting in Moscow in 1998 Gregorian year that IEA predicated oil sudden increase in future by accepting their viewpoints(MacKenzie, James J.2000) .

Decreasing oil production, increasing demand and rapid growth of economical development in lesser developed countries (like china and India) shows unfinished demand for oil and other energetic resources. The master of OPEC organization said demand for oil has been four folded from 1960 Gregorian year to now. Between 1995 to 2004 Gregorian year, daily consumption of oil in china was reached from 3.4 million barrel to 6.7 million barrel that this shows one hundred percent growth. China solely consumed thirteen percent of world oil production and also this procedure was hold for India. These two countries consumed eighteen percent of oil resource in world in 2004 Gregorian year.

2.1. Threatens and hindrances

Oil resources will finish and oil projects in huge volume of asset can be performed. Anyway, cheap oil period finished by decreasing oil production resources and refineries limitations that today work with full capacity and we will see incremental oil prices (Aziz Khan M.A. 2001). These are away from geopolitics problems that may happen in all around world. Today world will encounter with huge and great of volume of oil demand and this is when oil production level is decreased and 54 to 65 of oil production countries pass away from maximum and or a decade is passed. According to IEA report in 2007 Gregorian year and according to today consumption in world that is more than 80 million barrel in a day, we have oil only for 45 years in world (unless new resources will discover or considerable percents will add to usable resources amount). This is while if economical index growth rate will increase, this amount decrease to 25 years and today we see this decline. Also, unsuitable social and political and economical can be influential on these resources and all of these will finished. (Oil will finish). World economic is based on cheap and famous oil that excavate naturally or by low cost methods and this is while excavation cost and also reuse amount and needed technology is different from one resource to other. Totally, it isn't clear that how much unusual oil has been remained for discovering, discussed problems in this background consist of excavation probability, lesser heating value and need to novel technology. By considering that using such oils in future experimentally will not be irrational (oseph P. Riva Jr.1995). And maybe lasts 10 to 15 years. Universal need to oil will increase one to two percent annually. Today, one hundred oil barrels is excavated from ground in every second and universal growth percent will increase because of economical development in future. From decade 1960 to now very big squares or squares with high usable oil wasn't discovered and this is while predictions about discovering new squares is so challenging and is based on probabilities , most of oil resources that is declared and discovered in most of countries , is a kind of exaggerations . So, realities about oil include decreasing slope of oil universal production, universal increase in raw oil demand, universal increase in prices and untrusting to real volume of oil resources. In one hand, shortage in oil resources can cause economical sever challenges and most of refineries in world works with full capacity and this means world will have fragile position and with low resources, economical growth will have problems not only in developing countries, but also in industrial countries .It is clear that lesser developed countries and poor will have losses. Main problem is that finding a replacement for oil isn't simple work. Nuclear energy has its specific problems. And also will have more dangers in production, garbage ejection and illness prevalence and cancers and need to high technology and expensive and limitations in consumption. This energy isn't reusable and is expensive and also isn't available easily. And in fact, any of energies can't easily replace with cheap oil.

And all of energy application of other energies has less influence on decreasing procedure of oil resources. And also, none of energies has transposing ability and also heating energy in comparison with weight like oil. These cases can't be solvable solely, but shows great challenges in energy base changing (Laherrère 2001). So, there is a little need to universal cooperation for creating strong bases for changing and easiness in life style and energy base as there is little need to energy. anyway , world won't have enough oil energy for economical growth of countries in future . maximum usage of energy in world was begun about thirteen years ago and we see that energy production growth rate , hasn't emit past more power intonation , as has retardation against population rate .

3.1. OPEC predictions, IEA, EIA about resources and energy consumption in future:

According to EIA (American energy information office) all of energy resources will increase in 2009 Gregorian year. it is expected that oil universal price in periods between 2006 to 2030 Gregorian year was partly high and fluid fuels has the lowest growth in universal consuming resources . Fluid fuels consumption in 2006 to 2030 Gregorian year will have annual growth average about 9 percent. It is expected that fluid fuels had the most share in energy resources. Their share in universal energy consumption market decreased from 36 percent from 32 percent in 2006 to 32 percent in 2030.

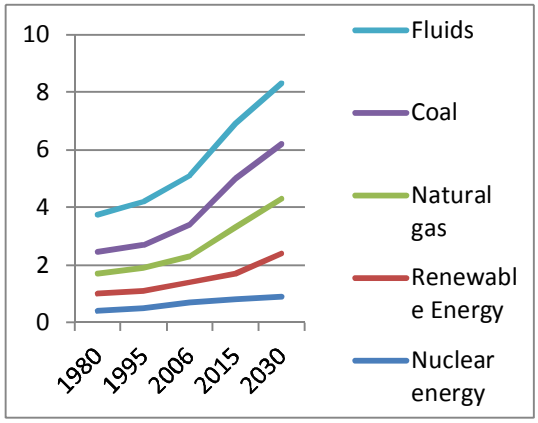

Fig1: universal energy consumption market

So, it is predicted that, oil universal price because converting industrial and electric parts of fluid fuel. According to OPEC organizations predictions , need to raw oil from 85 million barrel in a day in 2008 Gregorian year will reached to 105.6 million barrel daily in 2030 that shows 24 percent growth . This is while about 80 percent of this growth is related to china, south Asia and east south Asia or in other words Asian developing countries. Oil consumption level in North America and west Europe is negative. surveying oil consumptions growth level in world countries and especially (OECD) economical development cooperation organization was reached to maximum usage in 2005 Gregorian year , that will have negative growth 2030 in oil consumption Gregorian year , shows procedure consumption change from oil to other energies. The comparison present and previous predictions of three related organizations with statistics and related information to energy (OPEC , EIA , IEA) shows decline procedure of these raw oil in future and reaching these predictions together. Below table shows the comparison between OPEC organizations predictions and international agency and energy studies center in America of raw oil consumption in 2015 and 2030 Gregorian year . Also, according to EIA predictions (2008) producing world electricity 31.8 trillion kilowatt in hour in 2030 Gregorian year , is 77 percent more than 2006 Gregorian year that was about 18 trillion kilowatt . the most growth in producing electricity in non – OECD with 3.5 percent annual increase for increasing life standards and increasing demand in home consumption and extending commercial services includes hospitals , offices and buying markets . In OECD countries that foundations developed and population growth is partly smooth, it is expected that annual average increase about 1.2 percent between 2006 to 2030 Gregorian years. now , coal and natural gas have the most share in producing electricity in world (preparing more than 60 percent of world electric energy) and remain the most important energy preparing resources with 64 percent of total production in 2030 Gregorian year .

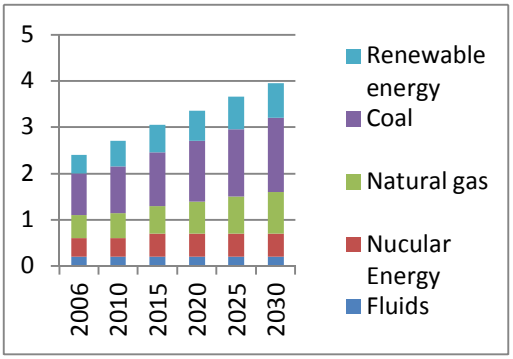

Fig2: OECD countries energy consumption market

According to OPEC predictions, oil share has been decreased between 1990 to 2006 Gregorian year . oil consumption predictions is negative for producing electricity in 22 years .

4.1. Declined dependency to oil (changing energy base from oil to gas)

More decreasing in resources level, decreasing validity and at last decreasing oil production security, force some of countries and oil companies to find replaced cases. Also, with improving universal economic and demand growth for raw oil, it is expected that this production will reach from 68 dollar in present to 110 dollar in every barrel in 2015 Gregorian year. and present consumption will reach from 85 million barrel in a day to 91 million barrel in 2015 Gregorian year that OPEC prepare about forty percent of this(Exxon. 2002). Oil company's managers accept this political reality that creating free market for financing in oil resources isn't in conversations list. About 80 percent of resources of universal resources aren't available for technology and specialist work force that oil companies can prepare part of this. Most of oil companies encounter with recession in production. But merging other companies isn't a way for increasing production. this is while despite of decreasing in consumption level prediction in 2030 Gregorian year (about 105 million barrel in a day) , producing oil should be 30 million barrel in a day , it means that about three times present Arabia production and this is difficult problem . Some of managers in companies accept governmental actions for limiting oil consumption as a way for improving presentation security and confronting with weather changes. Despite of oil, big companies that act in gas background confront with little limitations. Recession has been caused oil demand decline, while increasing in LNG and gas production in unusual methods, increase gas price about 25 dollars in a barrel of oil. Increasing gas production from unusual resources in America shows that how can a market react to price incentives when isn't encounter with financing limitations. Most of oil companies want governments to consider directing role for decreasing dioxide carbon pollutions. It is expected that natural gas demand growth level will be two times more than oil demand level to 2030 Gregorian year. And governments can persuade this procedure. Gas is burning material that has the most potential in decreasing pollution with the lowest cost. Electricity industry in America and china base fuel is coal, for replacing gas they can have big steps. Natural gas is the most important fuel for producing electricity in world because of more power and producing lower dioxide than other fossil fuels. According to EIA, natural gas total consumption is increased average 1.6 percent annually in 2007 Gregorian year. and predicted that natural gas total consumption will reach form 104 trillion cube foot in 2006 Gregorian year (114.5 trillion cube foot in 2010 Gregorian year) to 153 trillion cube foot in 2030 Gregorian year and its consumption will increase 1.2 percent in a year in electricity production part . Today, Member countries in Economical development and cooperation organization (OECD) have 38 percent of universal production and 50 percent of its consumption that shows 25 percent need these countries to foreign countries for import this production (Moreby, R, (2009)).also, to two next decade 40 percent of natural gas in world will be used in industrial parts and 35 percent of it will be used for producing electricity . according to IEA prediction , gas consumptions in next year's will have increasing growth and gas consumption will be about 5 percent for OECD , about 4.2 percent for developing countries in every year and Russia and for economic countries that change their fuel will be about one percent to 2030 Gregorian year . It is appeared that for answering to increasing demand growth for natural gas, produced countries of this product should increase their annual production to 48 trillion cube feet in a year. With short looking, we can know that most of suppliers of this increasing need in future will be countries such as Iran, Qatar and Russia.

2. Discussions

Oil is black gold that has main role in world economic and while mot of challenge sin world is oil and because of oil. Oil prepares industries fuels in centuries as a cheap energy resource. This huge energy resource decrease today and has been created worrying results for economical development in industrial societies. Also this problem, threaten even lesser developed countries that tries to reach economical index growth like west developed countries. according to what said about resources and political future of raw oil and by surveying gas and oil consumption predictions in future and decrease in consumption predictions and considerable growth of gas consumption productions and according to new created pollards in economic era and high energy consumption and tangible change in energy consumption procedure form oil to other productions and especially gas , it is appeared that tendency to financing volume level form oil to gas isn't out of expectation

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Designing curriculum that fosters psycho-social and accountability issues in agricultural education programs

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Abstract: How would the agricultural education curriculum be designed if the goal is to promote the development of psycho-social, entrepreneurship, and accountability in learners? To address this question, the course "management of agricultural enterprises in schools" offered to potential teachers at a college level was used as an experiment at one of the colleges of agriculture in the Southern African region. Participants' behaviors (performance, activities, conduct) were observed. The study recommended that the features of an education system in combination with proactive policies of education, and agriculture set the periphery for appropriate curriculum in agricultural education that could encourage the development of psycho-social, entrepreneurship and accountability in learners.

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Introduction

Curriculum in agricultural education fosters the development of multiple technical competencies and psychosocial characteristics. At Botswana College of Agriculture (BCA), a course entitled "AEB 425 management of school enterprises" was introduced five years ago as one of the core courses designed for preparing potential student teachers of agriculture. It is a 400 level course, designed for potential teachers of agriculture. According to the enrolment list, the course is taken by both pre-service (directly from senior school) and in-service students (who have taught before and those who trained with diploma and never been employed). The approach to teach the course were based on team-based learning, problem-solving, student-centered learning, and the application of prior knowledge to develop an understanding (Felder & Brent, 2003). Since then, there has not been any evaluation of the course to assess students' attitudes towards the curriculum. The question is, does the curriculum help participants develop psychosocial characteristics, competencies, and accountability needed in their teaching profession? For almost a century, the meaning of curriculum has been coined around by different scholars with the aim of designing models of education that foster desired outcomes and characteristics of learners (Esner, 1988). Generally, there are several definitions of curriculum (Abosi and Kandjii-Murangi, 1996; Posner, 2004) and many authors have highlighted different perspectives by which the concept of curriculum is considered. For example, UNESCO (2004) defined curriculum as comprising of the subject content that is "learned" and "taught"; "how it is delivered;" "assessed" "the resources used" as well as the expected outcomes. According to the UNESCO International Institute for Educational Planning (2006) curriculum is defined as a consolidated plan of learning experiences acquired through documented and non-documented activities found in an educational institution.

Interestingly, curriculum is one of the most powerful and significant elements of education programs (McNeil, 2001). It is a valuable aspect of education that is used to cause the required change to students' behavior in schools (Taylor, 1999). Studies have found that curriculum helps prepare individuals to acquire and develop characteristics that are needed for professional careers (Anamual-Mensah, Asabere-Ameyaw & Dennis, 2007). For instance, significant educational curriculum provides the opportunity for people to acquire a variety of expertise such as "computational skills, problem solving skills, initiative, logical thinking, creativity, adaptability, moral integrity, self-confidence, practical skills, and job-centered skills". As stated by Cline (2001) curriculum helps people develop universally accepted virtues of life which include "responsibility, self-discipline, gratitude, caring, compassion, self-control, cooperation, courage, honesty, loyalty, trust, empathy, and respect for self and others". Curriculum is therefore one crucial aspect of education, (Taylor, 1999) as it encompasses the desirable characteristics expected of a person who undergoes any form of education or training. Therefore, it is important to formulate appropriate and relevant curriculum to bring

about change in the understanding, attitudes and behaviors (Taylor, 1999).

To design the curriculum in generally, needs one to consider several factors (Taylor, 1999). According to Abosi and Kandjii-Murangi curriculum is more technical, it needs planning, "analysis of instructional materials, developing instructional units, creating programmed learning materials, and preparing computer software" (p.187). Posner (2004) noted five areas important in a curriculum plan; "the learners, the teachers", "the subject matter", "the milieu" and the "curriculum specialist" since they frequently impose the impact on what needs to be learned (Posner, 2004, p.35). Rogers and Taylor (1999) too found that designing curriculum needs specialists to (1) assess the accuracy of "the aims and goals" of the program (2) authenticate "the learning objectives" as well as (3) "the learning activities". According to Zinnah, Steele, Mattocks (1998), agricultural programs particularly in Africa face curriculum challenges which limit preparation of educators from acquiring relevant "knowledge and skills" to effectively perform their functions.

According to Kohlehr (2006) curriculum should be: flexible, outcome based, encouraging knowledge construction, and having a specific structure. Other attributes of curriculum include integrating psycho-social personality (UNESCO, 2006), and accountability (Hopkins, & Horstmeier, 2005). Practices in teaching and learning should help to build conducive environment that enables teachers realize the importance of being happy in the classroom. As indicated by UNESCO (2006), "Good teaching and learning practices are also good psychosocial practices". Based on the foregoing, this paper attempted to examine the curriculum at BCA facilitating psychosocial and accountability characteristics on student teachers using AEB 425 as a case study. Does the curriculum at Botswana College of Agriculture facilitate the development of psychosocial and accountability characteristics in student teachers? The purpose of the study was to describe the demographic characteristics, and psycho-social and accountability characteristics development by the participants during the "management of school enterprises" course.

Materials and Methods

Data for this study was gathered during a class "Managing Agricultural Enterprises in Schools" offered to trainee teachers of Agricultural education in the department of Agricultural Education Extension and Economics (AEE) at Botswana College of Agriculture (BCA). The study adopted the methodology described by Bloom, Dunn & Morse (1961) to gather classroom behaviors. Demographic characteristics, psycho-social and accountability characteristics of participants were described. A class of 92 potential teachers of agriculture who registered and took a course entitled "Managing agricultural enterprises in schools" at BCA from January to May, 2008 participated in the study. The class was purposively selected for the study to assess if the course provides psychosocial and accountability issues in managing a small-scale broiler production business to student teachers. The participants were informed about the researchers' intention to study their behaviour at the beginning to the end of the course to determine the psycho-social and accountability skills developed during their participation in the eight week period. The class was also informed that their participation records, academic scripts, written work, and attitudes towards the course would be observed and they should feel free to indicate if they did not want to be included in the observation. Participants also were informed that there would be no penalty imposed if they did not participate in the study. Two participants withdrew two weeks after the project was started leaving the group to be ninety. Participants were randomly assigned to 8 groups of 10-12 people on the first day of class to work in teams. The participants' record of work for 3 groups was used as outcomes of this study to describe the accountability of and psychosocial characteristics of participants.

Results

Table 1 presents the rubric designed to assess performance skills in schools' broiler enterprise, Table 2 shows the feed conversion efficiency estimated from average weight gain calculated by students, Table 3 represent the profit and loss statement for broiler enterprise, while Table 4 and 5 presented the unnecessary expenses incurred during management of broilers and bBalance sheet statement in a broiler enterprise respectively.

The results on demographic characteristics of the participants show that almost all (99%) of the participants had not owned poultry enterprises, approximately 60% had managed broiler enterprise, 40% had not been involved in broiler management, majority of the participants (52.3%) had previously managed school-based enterprises and 43% had never managed a any form of a business or school enterprises. Over ninety percentage (90.9%) of the participants indicated that their families did not own broilers, approximately 16% of the participants were in-service (having taught before), 84% were pre-service, 11% had worked in chicken farms, and 89% have not worked in any chicken farm. At least 77% of the participants were male, 33% female, 16.7% lived on-campus, 83.3% off-campus getting living allowance of BWP 1,700 per month, 0.03% were self sponsored, 38.9% were on 300 level while 61.1%

were completing at the end of the term. The participants' ranged between 26 to 39 years old.

Table 1 : A rubric designed to assess performance skills in schools' broiler enterprise

Skill	Performance scale				Points awarded
	Very good	Good	Satisfactory	Unsatisfactory	
Cleaning of the poultry house	12 points The cleaning of the poultry house was done in advance, before the arrival of chicks.	8 points The cleaning was done to average performance and accordance with respect to cleanliness and hygienic.	4 points The cleaning was imperfect though completed	0 points The cleaning was far from expected outcome	
Feeding	12 points Correct feeding times, correct feeding amounts, with all the necessary steps taken to remove the previous feed contaminated with droppings, saw dust - replacing the feeds in trays.	8 points Feeding performed with one aspect having been left out e.g. removing one aspect procedurally little cleaning, adding new feed to previous feeds	4 points Performed but without following the correct procedure of feeding, like replacing feeds without disposing the old ones	0 points When feeding has done partially, and chicks finish feed at intervals and empty feeders at the next feeding time	
Watering	12 points Providing correct amounts and clean water with all the necessary hygiene steps taken care of which ought to be done such as cleaning, unblocking the water pipes,	8 points Providing correct amounts and clean water with minimum hygienic steps taken care of.	4 points Providing correct amounts and clean water with no hygiene steps taken care of	0 points Not done due to failure to attend the project	
Records keeping	12 points Providing appropriate records on the enterprise such as amount of feeds given, number of bags opened, date opened, mortality, signatures of attendants	8 points Providing confusing records on the activities such as amount of feeds given, number of bags opened, date opened, mortality, signatures of attendants	4 points Providing partial or forged records on the activity conducted.	0 points No records	
Slaughtering	12 points Correctly done/completed according to the procedures of slaughtering	8 points Completed without following the procedures of slaughtering birds	4 points Partially completed	0 points Incomplete	
Marketing	12 points Completed all the marketing procedures including advertisement, pricing, packaging and selling	8 points Completed part of the marketing procedures.	4 points Partially Completed the procedures of marketing broilers	0 points Failed to market the product	

Table 2: Feed conversion efficiency estimated from average weight gain calculated by students

Week	Daily weight gain (kg) (ave)	Daily Feed Consumed (average)	Feed Conversion Rate	Weekly gain (kg)	Feed consumed (kg)	Feed Conversion Rate	Monthly gain (kg)	Feed consumed monthly	Feed conversion rate
1	0.06	0.02	0.33	0.42	0.53	1.27			
2	0.08	0.07	0.86	0.56	0.84	1.50			
3	0.2	0.32	1.14	1.4	2.41	1.72	2.30	5.40	2.35
4	0.25	0.33	1.32	1.75	3.5	2.0			

Table 3 : Profit and loss statement for broiler enterprise

Expenses				Income			
Description	Quantity	Unit price (BWP)	Total price	Description	Quantity	Unit price BWP	Total price BWP
Day old chicks	600	3.70	2220.00	Gizzards	50	7.00	350.00
Broiler starter crumbs	10	150.43	1504.30	Necks	48 pks	8	384.00
Broiler grower pellets	20	157.32	3146.40	Claws/legs	52	5	260.00
Broiler finisher pellets	32	155.33	4970.56	livers	42 pks	4	168.00
Stress pack 100g	1	22	22	Intestines	16pks	3	48.00
New Castle vaccine 100doses	1	18.15	18.15	Manure	-	-	-
TAD Gumboro vaccine 100 doses	1	33.00	33.00	Dressed birds	555	17.25/kg	13173.83
Wood shavings	3	49.50					
Wood shavings	3	57.20	250.25				
Oxyphen 100g	3	79.75	239.25				
Labor	5	32.00	160.80				
Plastics packaging	1pk	128.80	128.80				
Total expenses			**12841.21**	**Total income**			**14215.83**
Profit			**1374.62**				**14215.83**

Table 4 : Unnecessary expenses incurred during management of broilers

Description	Quantity	Unit price	Total price
High pressure gas brooder	1	699.00	699.00
High pressure gas regulator	1	308.00	308.00
Complete tube feeder	8	57.20	457.60
Total			1464.60

Table 5 : Balance sheet statement in a broiler enterprise

a) Current assets	**BWP**
Building and land	58800.00
High pressure gas brooder	699.00
High pressure gas regulator	308.00
Compete tube feeder	457.60
Total assets	60264.60
b) Liabilities	
Rent	823.00
Water	-
electricity	-
labor	160.00
Total liabilities	983.00
Total balance = Total assets – Total liabilities	60264.6.00 -93.00= 59281.80

Discussion

Table 1 shows the outcomes, (assessment rubric) developed by the participants in the study. Majority of the participants who carried out the task were motivated to contribute to the development of the instrument for assessing the practical skills in an agricultural project. They worked cooperatively as a team, actively contributing towards the development of the instrument, researched information, and also attended group work meetings. The group members interacted well with each other and consulted with professionals to improve their product. The

participants were able to through the task understood the need for acquisition of practical skills, and how they can be assessed objectively. The skills identified included; cleaning, feeding, providing water, administering vaccines, keeping records of their observations, slaughtering broilers, marketing the product, correct temperatures, cleaning equipment and surroundings, and indorsing their signature for completion of stipulated tasks (table 1). The participants outlined specific descriptions that conclude each skill gained, rated on a scale of what was done, timeliness and remarks. The groups noted the need for the instrument as a response to the policy of the Agricultural Education for Botswana that is applicable to students in junior secondary schools and constitutes part of their final mark in the course. The rubric developed was based on practical activities carried out by the students and culminates into a continuous assessment.

Table 2 shows the work of participants on the task of determining the feed conversion efficiency (FCE) in broilers. The participants were able to establish the need for determining FCE and how that will help improve the productivity of the farmers. The number of birds was obtained: the amount of feed in Kg was calculated after feeding thrice each day which was then extrapolated for each day, weekly or monthly. Ten chickens were randomly selected and weighed each week and the average weights recorded. The weight gained was also related to the stocking rate for the poultry house. The result in Table 2 shows that growth rate and feed conversion are inversely proportional to the floor space per bird. Through this tasks (keeping data, working in groups, computing analysis) student teachers were made more accountable in their learning activities.

Tables 3-5 presents the results on the preparation of financial statements for the poultry enterprise: balance sheet, profit and loss account and the unnecessary expenses included. The tables show data on every aspect of production and finances through to marketing gathered and computed by the participants on the task. The records as shown in Table 3 contained cost of purchasing the chicks, number of the chicks, feed, and cost of heating the brooder, labor, medicine, mortality and the profit obtained in the project. Table 5 presents expenses incurred in running the enterprise and also the income obtained from the enterprise. Table 6 presents data gathered by participants which show unnecessary expenditure in the business.

The participants were able to learn and gain more from the preparation of the account statements as they might have carried out of transferred learning of the concepts from other relevant courses during their program of study. The fact that they managed the broiler enterprises themselves, kept records and applied several of the business management concepts learned from their core and elective courses, made them more accountable as shown in Tables 3 -5. They were able to demonstrate the profitability of the broiler enterprises managed during AEB 425 course, ability to work together, active participation, high level of skill development, positive attitudes towards learning, and also identified unnecessary expenses incurred in the business (Table 3-5). The paper has clearly shown that through the course students were able to improve their psycho-social and accountability characteristics. Participants' behaviors (performance, activities, conduct) that were observed during the course suggests that the allocation of tasks to student teachers in the management of agricultural enterprises in schools course offered them hands-on experience to be more responsive to agricultural curriculum than the conventional class room teaching and examination. The awareness by the participants in the course that their classroom behaviours were being observed motivated learning and acquisition of skills in unusual way. It is therefore recommended that activities and tasks that will improve the psycho-social and accountability characteristics of learners be introduced into more courses and that AEB 425 should focus more on different agricultural enterprises for the would-be teachers.

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Constraints related to use of Information Communication Technologies tools among extension officers in the North- West Province, South Africa.

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Abstract: A simple random sampling technique was used to select 169 extension officers to examine the use of information communication technologies among extension officers in North West Province, South Africa. Data were collected with a structured questionnaire and analysed using frequency counts, percentages and multiple regression analysis. The results show that majority of the extension officers were male (76%) with the mean age of 44.6 years, married (79%) and 82.5% were Christians. Forty one percent of the extension officer had Diploma as their educational qualification and a mean of 16.7 years as working experience. The result revealed that extension officers perceived five of the ten constraints as serious in using ICT's. These specific constraints include: failure of service, poor basic infrastructure that encourages ICT, inability to maintain the ICT, too costly as well as non-availability of technical personnel. Significant determinants of constraints related to ICT use were working experience (t = 1.80, p = .073); awareness of ICT (t= 1.77, p = .078); effect of ICT on information access (t= -2.59, p = .010); officers e-readiness (t= 2.41, p =. 017) and use of ICT (t= 8.59, p = .000). The study recommends that as extension officers become more aware of the use of ICT, the less the constraints related to ICT use will be experienced.
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Key words: South Africa, extension officers, information communication technologies, tools, constraints.

Introduction

There is a growing demand for improving agricultural production to meet the challenges of food security, especially in the developing countries where the gross national earnings of these countries are low, and cannot afford food imports. Agricultural development by means of introducing technologies, inputs and improved farming practices are becoming increasingly important for the sustainability of agriculture as a promising and economical venture in a long run (Mudannayake, 2006). Therefore the use of ICTs amongst extension officers is of great importance so as to improve and contribute to the development of agricultural production.

The important role played by extension services in providing linkages and support to agricultural research in information and technology for farmers and farming communities has been crucial to agricultural successes in most developed countries. Public extension services have been ineffective in reaching farmers and farm communities with information and technologies needed to ensure food security and sustainable development (FAO, 2004). The situation is exacerbated by lack of skills by extension officers in using ICTs to promote new farming technologies, to enhance the flow of farming information relating to inputs, finance and marketing activities amongst others and bridging the rural digital divide.

ICTs play an important role in maintaining the flow of information within the agricultural macro production system which consists of researchers, extension officers and the farmers. Agricultural extension and advisory service has long been recognized as an important factor in promoting agricultural development in both developed and developing countries. Many countries around the world established organizations for the promotion of ICTs because it is feared that less technologically advanced areas have a chance to catch up, the increasing technological advances in developed nations will only serve to exacerbate the already existing economic gap between the technologically 'have' and 'have not' areas (Munyua, 2008). The situation is no less different in Africa and South Africa especially the North-West Province.

Despite the different roles and functions that agricultural extension and advisory service should play, much leaves to be desired for the use and integration of ICTs in the agricultural extension and advisory services in South Africa. Furthermore, the Extension Recovery Plan also highlighted that, the extension and advisory service in South Africa needs to be re-skilled and re-oriented because the majority of the extension officers do not have proper skills to use ICTs. The research report by DAFF (2009) highlighted that the North-West Province was amongst the provinces which had a more healthy extension and advisory services. However, the

inefficient use of ICTs by extension officers in the province poses one of the challenges for the dissemination of agricultural information and delivery of agricultural technology. In South Africa, majority (81%) of the extension officers who are in need of being re-skilled and re-oriented, will experience problems and obstacles in using ICTs as a form of accelerating agricultural growth, disseminating and transferring new farming information and technologies(DAFF,2009).

Leeuwis (2004) states that agricultural extension has the ability to solve many of the challenges that agriculture is facing, but it needs to be made attractive. Indeed, the nature of agricultural extension itself is challenging since it involves working with the farming community (which is not easy as we need to understand rural life and human behavior), have a good knowledge on agriculture (pest and disease management, market prices and opportunities, other stakeholders in agriculture and their role etc.) and have specific skills (good communication skills, listening skills, be a trainer and learner at the same time etc.).

Materials and Methods

The study was carried out in North West province, South Africa. The study population included all extension officers (200) in the province. A simple random sampling technique was used to select 169 extension officers from which data were collected. A structured questionnaire was designed based related literature and objectives of the study and comprised 21 items categorized as uses of information communication technologies. Validity of the instrument was ensured through a panel of experts in the Departments of Agricultural Economics and Extension and extension professionals from the Department of Agriculture and Rural Development, South Africa. The questionnaire had a reliability coefficient of 0.92 using the split half technique. Data were analyzed with Statistical Package for Social Sciences (SPSS) using frequencies, percentages, mean and multiple regressions.

Results

Table 1 shows the personal characteristics of extension officers in North West Province, South Africa. Table 2 shows the mean and standard deviation of 10 constraints related to uses of ICT tools by extension officers which were rated on a 2-point scale of Yes (2), and No (1). The result of multiple regression analysis of the constraints related to use of information communication technologies by extension officers were presented in Table 3.

Table 1. Personal characteristics of extension officers.

Personal characteristics	**Description**
Gender Predominantly	male 76%
Age Mean	= 44.6 years SD = 5.40
Marital status	79% married
Religion Predominantly Christianity	82.5%
Educational level Predominantly diploma	41% , BSc =15%
Household size Mean	= 4.8 persons SD = 1.20
Working experience Mean	= of 16.7 years SD = 4.50
Living in job location Predominantly	Yes 79%, , No 21%
Job designation Predominantly	extension officer 53%,Senior/Chief agricultural technicians 36%

Table 2. Constraints related to use of ICT among extension officers in Northwest Province

Constraints	**Yes**	**No**	Mean	SD
Failure of Service	110 (65.1)	59 (34.9)	1.56	.65
Poor basic infrastructure that encourages ICT.	110 (65.1)	59 (35.0)	1.54	.68
Inability to maintain the ICT	102 (60.4)	67 (39.7)	1.52	.64
Too costly	97 (57.4)	72 (42.6)	1.43	.72
Non-availability of technical personnel.	97 (57.4)	72 (42.4)	1.47	.67
No skillful operator	83 (49.1)	86 (50.9)	1.39	.65
Non availability of genuine components and parts.	78 (46.2)	91 (53.8)	1.33	.69
Fluctuation/shortage supply of electricity.	71 (42.0)	98 (58.0)	1.37	1.05
Fake and substandard ICTs product in the market.	63 (37.3)	106 (62.8)	1.20	.70
Illiteracy	66 (39.1)	103 (60.9)	1.20	.73

Table 3. Determinants of constraints on the use of ICT tools by extension officers.

	B	Std. Error	Beta	t	Sig
(Constant)	.029	3.218		.009	.993
Gender	1.063	.817	.088	1.301	.195
Age	-.035	.055	-.060	-.640	.523
Marital Status	-.146	.270	-.037	-.540	.590
Number of children	-.084	.296	-.022	-.284	.777
Religion	.167	.469	.022	.357	.722
Highest qualification	.315	.208	.090	1.516	.132
Studying for a higher degree	-.066	.626	-.006	-.105	.916
Household size	.126	.163	.051	.773	.440
Working experience	.078	.043	.159	1.805	.073
Living in job location	-.058	.781	-.004	-.074	.941
Place of residence	-.194	.568	-.021	-.341	.733
Number of farmers covered	.000	.001	-.048	-.782	.436
Distance to farmers	6.328E-5	.001	.007	.110	.912
Awareness of ICT	.051	.029	.202	1.776	.078
Availability of ICT	.045	.045	.160	.989	.324
Accessibility to ICT	-.075	.055	-.277	-1.373	.172
Competence on ICT use	-.009	.044	-.037	-.208	.835
Importance of ICT	.015	.031	.061	.471	.638
Effect on information access	-.056	.022	-.176	-2.599	.010
Officers e -readiness	.196	.081	.163	2.415	.017
Use of ICT	.370	.043	.612	8.595	.000
F	8.207				
P	000				
R	.735				
R squared	.540				
Adjusted R squared	.474				

Discussion

From Table 1, majority of the extension officers were male (76%) with the mean age of 44.6 years, married (79%) and 82.5% were Christians. Forty one percent of the extension officers had a diploma as their educational qualification and a mean of 16.7 years as working experience. There was a mean of 4.8 persons per household and 79% live in their job location, rural or peri urban notwithstanding. In terms of job designation 53% were extension officers. Bembridge, (1991) also reported similar findings in terms of the personal characteristics of extension officers in South Africa. Table 2 shows that from a total of 10 constraints, 5 prominent constraints were identified by extension officers as having more limitations to agricultural extension work in the North West Province which were failure of service (1.56), poor basic infrastructure that encourages ICT (1.54), inability to maintain the ICT (1.52), too costly (1.43) and non-availability of technical personnel (1.47). This supports the argument that the problems of poor ICT Infrastructure development, maintenance, electricity and overbearing costs and lack of technical personnel are deterrents to ICT utilization in developing countries.

Similarly, Akpabio, Okon & Inyang (2007) indicated that the major constraint perceived by extension workers in Nigeria was attributed to poor infrastructure development. Ahmadpour, Mirdamadi, Hosseini and Chizari (2010) noted that in Iran the financial factor, plays an important and critical role because the base and setting of e-learning system such as telecommunication infrastructure, buying computer, access to internet, expense of maintenance of equipment and other ICT resources need financial and credit and continuing e-learning projects needs investment .Furthermore, the findings of Khan (2001), Kushner and Chong (2004), and Stribhadung (2006) showed that the high cost of buying and maintaining a system adversely affected the deployment of ICTs.

The findings by Ekwe Agwu and Uche-Mba (2010) revealed that in Enugu State Nigeria, lack of competence in handling ICT facilities, unavailability of hard ware required by modern ICT, poor finance, lack of adequate awareness about ICT, lack of internet access to the rural areas, poor communication network and nature of information provided were considered as serious constraints to the use of ICTs by extension workers. This implies that extension officers who operate from funding hampered and

poor basic infrastructure that encourages ICT and office accommodation are exposed to the continuous failure of ICT service not from the erratic power supply available from the national electrical supply grid. The findings by Salau and Saingbe (2008) indicated that poor supply or lack of electricity supply was rated highest by extension workers in Nasarawa State, Nigeria. Other constraints following the order of magnitude were inability to operate some ICTs, financial problem, poor access to ICTs and lack of interest.

In Table 3, the independent variables were significantly related to constraints related to use of ICT with the F-value of 8.207, $p < 0.05$ showed that there was a strong correlation between independent variables and constraints related to use of information communication tools. The result further predicted a 54.0% of the variation on the constraints related to use of ICT by extension officers. Significant determinants were working experience ($t = 1.80$, $p = .073$); awareness of ICT ($t = 1.77$, $p = .078$); effect of ICT on information access ($t = -2.59$, $p = .010$); officers e- readiness ($t = 2.41$, $p = .017$) and use of ICT ($t = 8.59$, $p = .000$). This suggests that when extension officers acquire more working experience, they will be able to overcome the constraints related to ICT use more,, on the contrary, Salau and Saingbe (2008) indicated that years of working experience of extension officers had a negative impact and a negative relationship on the utilization of ICT. The study showed that the constraints related to use of information communication tools by extension officers in North West Province, South Africa were failure of service (1.56), poor basic infrastructure that encourages ICT (1.54), inability to maintain the ICT (1.52), too costly (1.43) and non-availability of technical personnel (1.47).Significant determinants of constraints related to use of information communication tools by extension officers were working experience, awareness of ICT, effect of ICT on information access, officers' e- readiness and use of ICT. The highlighted constraints related to ICT use will help extension officer's e- readiness level to improve and in becoming more aware of the use of ICT as well as the effect of ICT on information access will be influenced by the number of constraints related to ICT use.

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Use of storage facilities by small-scale farmers in the Lejweleputswa District Free State, South Africa

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Abstract: A descriptive research design was used to analyse use of storage facilities by small scale farmers in Lejweleputswa district of Free State. The population of study is all small scale farmers in Lejweleputswa district of Free State, South Africa. Simple random sampling technique was used to select 120 farmers representing five percent of the population and data were collected through the use of structured questionnaire that consist of socio-economic characteristics, types f storage facilities and purpose of storage. Data collected were analysed with statistical package for the Social science using frequencies, percentages and multiple regression analysis. The results show that most farmers are female; married; practised Christianity; having personally sourced agricultural land; farming full-time; not members of any agriculturally-oriented organization. Many farmers do not have both metal and cement silos. The main purposes for storing their produce was food security; the increase for the prices of their produce; house-hold consumption throughout the year; and lack of market accesses for their produce. Significant determinants of use of storage facilities were anticipated price increase, household consumption, preservation of planting materials, primary occupation and farming experience.
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Keywords: storage facilities, small-scale, farmers, Lejweleputswa District, livelihoods

Introduction

Agriculture is the livelihood of small-scale farmers and plays important roles in South Africa as it contributes to GDP, employment, rural development and food security. Small-scale farmers contribute to the development of South Africa through agricultural production. However, the literature reveals that small-scale farmers are faced with many production problems like poor or no storage facilities (World Bank, 2005); market inaccessibility and information (Wouterse, 2006:33); lack of infrastructure (e.g. roads, buildings) (UNAIDS, 2006:135); lack of capital (Pingali, Khwaja & Meijer, 2005:56); inaccessibility to extension services (Winters, McCulloch & McKay, 2004:93); inadequate land reform policies (Acemoglu, Johnson & Robinson, 2002:1252); inadequate government support (Ruben & van der Berg, 2000:35); lack of transportation (Rodrik, Subramanian, Trebbi, 2002:78); lack of resources (e.g. production inputs) (Sachs, 2001:930); lack of water (Johnson & Robinson, 2002:1252); and lack of finance (Aksoy, 2005:49) amongst many other problems.

In South Africa, produce from small-scale farmers is often lost after production due to spoilage during storage and inability of small-scale farmers to access storage facilities. This reduces small-scale farmer's ability to participate in formal market (Valdes & Foster, 2005:23). According to Tsangarides, Ghura & Leite (2000:15), poor storage facilities will often mean that farmers are forced to sell at peak times when prices are low. This is because farmers experience losses due to damage to their produce because of lack of appropriate storage facilities (Reardon, Stamoulis, Cruz, Baliscan, Berdegue & Banks, 1998:21; Topouzis, 1999:33). Umali-Deininger and Sur (2006:47) observed that although many tropical and sub-tropical regions have great potentials for food production because of the enabling climatic conditions, they have not been able to achieve food self-sufficiency because pests, diseases and other agents compete with humans in their struggle to ensure that adequate food is available to meet the population requirements. Efficient storage of farm produce plays a vital role in the attainment of food security. Efficient storage of produce depend on a number of factors one of which is the availability of the structures to hold the produce. There are a number of storage facilities and the choice depends on type of produce, volume of storage and technical and economic situations of the individual involved in the storage (Van den Meer, 2006).

Aksoy, (2005) reported on the impact of maize storage on rural household food security in Northern KwaZulu-Natal. This was based on the premise that the incidence of hunger is high among rural South African households (Labadarios, 2000:4-5). Transient hunger is partly attributed to seasonal production, especially of staple crops (maize in the case of KwaZulu-Natal). Effective storage plays an important role in stabilizing food supply at the household level by smoothing seasonal food production. However, despite significant advances in food storage methods, many African and South African

communities still rely on traditional storage methods for food, fodder and seed. Although relatively simple and inexpensive to construct and maintain, traditional storage systems lead to substantial post-harvest losses (Aksoy, 2005:49; UNAIDS, 2006:109). Inadequate post-harvest storage contributes significantly to food insecurity and more so in areas with high humidity as experienced in KwaZulu-Natal (Valdes & Foster, 2005:53). Storage facilities not only offer the opportunity to smooth hunger between staple crop harvests but farmers are possibly able to improve farm incomes by storing crops and selling at premium prices when demand outstrips supply later in the post-harvest period (Umali-Deininger & Sur, 2006:119). As quality is an important determination of crop retail prices (World Bank, 2005), effective storage is crucial to improve agricultural incomes and food security for small scale farmers. Grain storage practices in Nigeria vary according to climatic zones and socio-economic level of inhabitants (Igbeka and Olumeko 1996). Despite the desire to store maize, some farmers often sell a large proportion of their produce at harvest, when the price is low (Whitehead 1998). Strahan and Page (2003) observed that such farmers considered storage to be too costly in terms of time or too risky in terms of losses and unpredictability of future prices, or unprofitable in relation to an alternative investment. Meikle et al. (2002) reported that most farmers store maize using indigenous storage structures for the purpose of self-sustenance and household food security. These storage techniques are local and crude; some have been found to be functional, needing just a little improvement, whereas others are outdated and hazardous (Thamaga-Chitja et al. 2004). The main objective of this paper is to identify and analyse the use of storage facilities by small scale farmers in the Lejweleputswa District Free state, South Africa The specific objectives of the study were to determine the socio-economic characteristics, identify types of storage facilities used, and purposes for storage. The study also explored the significant relationship between socio-economic characteristics and use of storage facilities among small scale farmers.

Materials and Methods

The study was conducted in the Lejweleputswa district in the Free State. Lejweleputswa district is located in the north of Free State province. The main activities in this district are mining and agriculture. The main types of agricultural farming in this area are mainly crop farming (e.g. maize, sunflower and wheat) and livestock farming. The weather in this area is mainly very cold in winter and with highly hot summers with high summer-rainfalls. A descriptive research design was used to analyse use of storage facilities by small scale farmers in Lejweleputswa district of Free State. The population of study is all small scale farmers in Lejweleputswa district of Free State, South Africa. From the list obtained from the Lejweleputswa district Department of agriculture, Conservation, Environment and Rural Development, simple random sampling technique was used to select 120 farmers representing five percent of the population. Data were collected through the use of structured questionnaire that consist of socio-economic characteristics, types f storage facilities and purpose of storage. Data collected were analysed with statistical package for the Social science using frequencies, percentages and multiple regression analysis.

Results

Table1 shows the socio-economic characteristics of farmers in Lejweleputswa district, Table 2 presents the types of storage facilities used by respondents, Table 3 states the purposes for storing among respondents and Table 4 presents the multiple regression analysis of relationship between socio-economic and use of storage facilities.

Discussions

Table 1 presents personal characteristics of the farmers in the Lejweleputswa district. The table shows that the majority of the respondents were female (56%); married (54%); practised Christianity (99%); having personal agricultural land (54%); farming full-time (77%); having high school education (48%); not members of any agricultural organization (56%) and having contacts with extension agents (71%). Also, the respondents were having less than 10 years farming experience (85%); having less than 9 persons as household size (96%); having less than 7 dependants (87%); having more females in their house-hold (97%); not engaged in non-farming activities (56%); practising mixed farming system (70%); and having farm income ranging between R45000-R80000. Mainly, the respondents aged from 42 to 60 years of age (49%); using hired labour (46%); and having storage facilities acquired through purchase (41%). It is pleasing to note that female form the majority of farmers in the Lejweleputswa district which is indicative of women empowerment. This could also be the result of sampled farmers' households consisting of more females than males and as a result that the male have moved from agricultural into the mining sector.

The use of hired labour could be linked to the involvement of majority women in farming activities and who seek support from hired labour. The age range of majority of farmers in Lejweleputswa District (42 to 60 years) is indicative of lack of involvement of youth in agricultural activities. The farmers do not have strong educational background with most them having high school education which could limit their adoption of innovations. It is also disturbing to note that farmers have to purchase storage facilities, which could create financial constraints for farmers intending to be

actively involved in farming. From the list of storage techniques listed in Table 2, only 3 out of 8 were prominently used by farmers.

Table 1 Socio-economic characteristics of farmers in Lejweleputswa district

Variable	Frequency	Percentage
Gender		
Male	53	45
Female	66	55
Age		
<40	43	34
42-60	55	49
Above 60	21	17
Marital status		
Single	40	34
Divorced	5	4
Married	64	54
Widow	10	8
Religion		
Christianity	118	99.2
Others	1	0.8
Educational level		
No formal education	2	2
Primary school	38	32
High school	57	48
Tertiary	22	18
Sources of land		
Personal	64	54
Rented	9	8
Allocated through land reform	46	38
Organizational membership		
Yes	52	44
No	66	56
Extension Contact		
Yes	84	71
No	34	29
Labour sources		
Self	26	22
Family	36	32
Hired	55	46
Farm Income		
8000-20000	17	14
22000-40000	18	15
45000-80000	26	22
83000-300000	21	17
Number of years farming		
<10	101	85
11-20	10	8
24-40	7	7
House hold size		
<9	114	96
10 above	4	4
Non-farming activities		
Yes	52	44
No	67	56
Farming system		
Crop based	27	23
Mixed	83	70
Grains based	9	7

The prominent storage facilities are use of ground/floor (45%) metal silos (33%) bags/sacks (31%) and metal/ plastic drums (28%). This result has shown that there is high need for storage facilities among small scale farmers in the study area. This may be due to the fact that these are subsistence farmers without necessary support and facilities. The low scale of production associated with subsistence farming could be responsible for non-investment in storage facilities by farmers. The consequences of the lack of storage facilities would impact on food security in terms of produce availability particularly at off-season.

Table 2: Types of storage facilities used by respondents

Type of Storage	Frequency	Percent %
Metal Silo		
Yes	39	32.8
No	80	67.2
Cement Silo		
Yes	26	21.8
No	93	78.2
Metal/Plastic drums		
Yes	33	27.7
No	86	72.3
Bags/Sacks		
Yes	37	31.1
No	82	68.9
Solis wall Bins		
Yes	3	2.5
No	116	97.5
Storage on the ground/floor		
Yes	54	45.4
No	65	54.6
Under-ground		
Yes	26	21.8
No	93	78.2
Storage sacks		
Yes	2	1.7
No	117	98.3

Table 3: Purpose for storing among respondents

Purpose for storing	Frequency	Percent
Food security		
Yes	77	64.7
No	39	32.8
For prices of your produce to increase		
Yes	86	72.3
No	26	21.8
For household consumption through the year		
Yes	69	58
No	45	37.8
Lack of market accesses for your produce		
Yes	103	86.6
No	10	8.4
For future planning for drought		
Yes	81	68.1
No	31	26.1
To use next season as seed		
Yes	48	40.3
No	66	55.5

Table 4: Multiple regression analysis of relationship between socio-economic and use of storage facilities.

Model	Unstandardized coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	10.903	.793		13.743	.000
Constraints	.022	.013	.160	1.631	.106
Food security	-.101	.256	-.056	-.394	.695
Price increase of produce	.555	.220	.335	2.516	.013
Household consumption	.478	.261	.285	1.834	.070
Lack of market accesses	-.234	.220	-.122	-1.062	.291
Drought	.000	.198	.000	-.001	.999
Use as seed	-.524	.157	-.303	-3.339	.001
Age	.007	.007	.099	1.012	.314
Marital status	.120	.086	.129	1.407	.162
Religion	-.166	.215	-.063	-.772	.442
Occupation	-.309	.184	-.141	-1.679	.096
Organisation membership	-.140	.166	-.074	-.845	.400
Farm income	2.275E-6	.000	.118	1414	.161
Farming experience	-.043	.013	-.288	-3.237	.002
F	4.076				
Sig.	.000[a]				
R	.597[a]				
R Square	.356				

Table 3 shows that the purpose why farmers store their produce include food security (65%); for the prices of their produce to increase (72%); for house-hold consumption throughout the year (58%); lack of market accesses for their produce (87%); proactive planning for drought (68%); and seed preservation (planting materials) (56%). This finding is consistent with Minot (2005) assertion that most storage is carried out by farmers in anticipation of future household needs. It was indicated that small-scale farmers store their produce for purposes of food security; for proactive investment for future prices increases; for availing sufficient food for their families throughout the year; and for proactive planning for the possibility of drought in the future. Most of South Africa is drought-prone, obliging farmers to develop coping responses to deal with the phenomenon (Myburgh, 1994). It is worrying though that farmers store their produce because of lack of market accesses for their products which could be frustrating and warrants the intervention of government and other big businesses. Bailey *et al.,* (1999) argue that many communities complain of insufficient access to traders' mainly due to traders that are reluctant to make trips because of high transaction costs they incur due to poor physical infrastructure such as roads and loading facilities, as well as distance to reach farmers.

The result of multiple regression analysis of the relationship between demographic characteristics and use of storage facilities by small-scale farmers is presented in table 4. The independent variables were significantly related to use of storage facilities by small-scale famers with an F value of 4.08. Also, an R value of 0.60 showed that there was a strong correlation between the independent variables and use of storage facilities by small-scale farmers. Significant determinants were use as seed (t = -3.34) and farming years (t = -3.24), anticipated increase (t = 2.52), household consumption (t = 1.83) and primary occupation (t= - 1.68). This finding imply that, the longer the years farming and the more the produce are intended for use as seed in the next season, the higher the use of storage facilities. These findings highlight a great need for government involvement in helping small-scale farmers.

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Effect of Supervisors' Specialization on Job Performance of Agriculture Science Teachers in Botswana Junior Secondary Schools

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ABSTRACT: This paper examines the effect of supervisors' specialization on job performance of agriculture science teachers in Junior Secondary Schools. A simple random technique was used to select 49 agricultural science teachers and 13 supervisors. The teachers were divided into those whose supervisors specialize in agriculture science (ATAS) and those with supervisors do not (ATNAS). Data collected with a structured questionnaire that was face validity and has reliability coefficient of 0.92 were analyzed. The results shows that majority of ATAS and ATNAS indicated that a higher proportion of the supervisors who have the same subject specialization perform their supervisory roles than supervisors who do not specialize in the same subjects. Significant differences exist in the perceived effect of supervision ($F = 27.93$, $p < 0.05$) and between ATAS and ATNAS, on Supervisors' specialization ($t = 14.97$, $p < 0.05$), and job performance ($t = -3.00$, $p < 0.05$).
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Keywords: supervision, subject specialization, agriculture science, Teachers, Botswana

Introduction

The education system in Botswana has undergone drastic development and expansion over the years. Schools as institutions are made to offer opportunities to develop and prepare students for the world of work and self – sustenance. Thus, agriculture was introduced in junior schools in order to educate and teach agriculture to younger people to contribute to food security and self employment. The government of Botswana has invested in developing the teaching of agriculture in schools. The materials, equipment, funds and teachers are allocated to schools every year to enhance the learning of agriculture. Supervision is, therefore, necessary to maintain standards and to ensure that the money and other resources are being used most effectively in the interest of students, and that students are exposed to improved teacher instruction (Malambe 2003 and Elegbeleye 2005). The drastic increase in number of students and teachers stretched the management capabilities by school heads such that the increase in the number and spread of educational institutions in the country, especially, at primary and secondary school levels poses a problem of effective administration in view of the centralized nature of the management structure(Teaching Service Management (TSM), 1994). The situation resulted in the initiation of decentralization of some supervisory roles at Ministry of Education and school levels. The restructuring of management in schools came up with the new scheme of service and job description for teachers. The paradigm shift was done with the hope of improving supervision in schools and the creation of the head of department (academics) position in junior secondary schools was to meet the changed situations caused by the complexity of the curriculum. The diversity of the subjects required supervision in subject matter fields. The curriculum is divided into three categories namely: Sciences (Science, Agriculture and Mathematics), Humanities (Setswana. English, Social Studies, Moral education), and Practical subjects/options (Design and Technology, Art and Home economics). The head of department for sciences subjects is responsible for supervising agriculture teachers as well as teachers from other two subjects (Mathematics and Integrated Science). The head of department post is attained through application and teachers are interviewed by a panel of directors from the Regional Education Office. All teachers under a particular department are eligible for the post of senior teacher (head of department). The teacher should have given satisfactory service for at least two years as senior teacher grade two, and should have demonstrated leadership qualities. The experience acquired should be demonstrated in both teaching and administrative skills (Teaching Service Management, 1994). The teacher is also assessed on the level of knowledge of the education act, code of regulations, educational policies and problem solving pertaining to discipline in school and conduct of teachers. Then on the basis of the panel assessment, the teacher is entrusted with the supervisory roles in schools. The head of department is guided by the job description and scheme of service under supervision

of the deputy school head. The Teaching Service Management (2000) outlined that the head of department is expected to execute the following supervisory rules: coordinate work of the department, coordinates in – service programs, guides and counsel teachers, plan for class allocation, prepares order books, teaching aids and other resources for approval by the school head , organizes mock examinations and ensures that students are exposed to examination conditions as close as reality is possible, approves the preparation of scheme of work, keep records to correspondence relating to the department, ensures time management in the department, monitors standards of work in the department, act as point of contact for the ministry, comments on annual confidential reports prepared by for members of his/her department, trains subject coordinators to induct and support probationers more effectively, recommends time needs, convenes meetings in the department and attend meeting convened by the school head to discuss matters of school policy, submit departmental plans, undertakes the full range of teaching duties and other related duties to meet the objectives of the service. Sallis (2001) outlined these roles for effective supervision.

However, it has been observed that in most cases heads of departments (Sciences) supervise agriculture teachers but do not specialize and teach agriculture instead major in Mathematics or Integrated Science. The heads of agriculture department have been criticized for inefficiency in conducting lesson observations and teachers have complained of lack of support from head of department. It is therefore important to determine the effect of supervisors' specialization on the performance of the supervisees, as some supervisors in junior secondary schools supervise teachers of the subject they do not teach.

Materials and Methods

Southern District is one of the countries nine districts. It is located in Southern Botswana, also known as Ngwaketse District. The district's is on latitude 25°, 0'0''S, longitude 25°, 0'00'' E. It is a first administrative division with a population of 79888 and covers an area of 28 470km$^{2.}$ Domestically it borders the following districts: South East District, Kweneng District and Kgalagadi District. Major village and town in this district are Kanye and Lobatse. The study covered all seven junior secondary schools in Kanye and four in Lobatse. The targeted population was agricultural science teachers and their supervisors in Kanye and Lobatse Junior Secondary Schools. A sample of 49 agricultural science teachers were selected randomly and 13 supervisors of those agriculture teachers were used for the study to give a total sample size of 62 respondents. A structured questionnaire was designed and face validated among Lecturers in the Department of Agricultural Economics, Education and Extension was used to collect data for the study and contains sections on demographic characteristics of agriculture teachers and their supervisors. Job performance which was measured on 3 point Likert-type scale, Very effective = 3, effective = 2 and not effective = 1. Teachers' perception of the supervisors' specialization on supervision of Agricultural science in junior secondary schools anchored a 5 point Likert – scale of strongly agree = 5, agree = 4, undecided = 3, Disagree = 2 and strongly disagree = 1 and effect of supervision on job performance measured on a 3 – point Likert – scale, very effective = 3, effective = 2 and not effective - 1 was used. Data collected were analyzed with the SPSS programme using Frequencies and percentages

Results

Table 1 presents the demographic information of agriculture science teacher and supervisors, Table 2 shows the perceived effect of supervisor's specialization on supervision of agriculture teachers, Table 3shows the effect of supervision on job performance, Table 4 and 5 state the job performance and roles of agriculture teachers. Table 6 shows the One way analysis of variance showing difference in the effect of supervision and job performance among ATAS, ATNAS and Supervisors, while Table7 presents the t-test analysis showing differences between ATAS and ATNAS on effect of supervision and job performance.

Table 1: Demographic information of agriculture science teacher and supervisors

Variable	ATAS	ATNAS	Supervisor
Gender			
Male	17(65.4)	13(56.5)	11(84.6)
Female	9(34.6)	10(43.5)	2(15.4)
Age			
Less than 30	8(30.8)	5(21.7)	1(7.7)
31 - 35	15(57.7)	11(47.8)	8(61.5)
36 - 40	3(11.5)	6(26.1)	2(15.4)
More than 40	0(0)	1(4.3)	2(15.4)
Nationality			

Motswana	26(100)	22(95.7)	12(92.3)
Expatriate	0(0)	1(4.3)	1(7.7)
Educational Qualification			
Diploma In Agric Educ	18(69.2)	10(43.5)	7(53.8)
Bsc + PGDE	2(7.7)	9(39.1)	2(15.4)
Bsc Agric Education	4(15.4)	3(13.0)	4(30.8)
Other	2(7.7)	1(4.3)	0(0)
Teaching Experience			
Less than 5 years	9(34.6)	4(17.3)	3(23.1)
5 – 10 years	12(46)	12(52)	10(77)
Above 10 years	5(19.2)	7(30.3)	0(0)
Marital Status			
Single	17(65.4)	8(34.8)	8(61.5)
Married	9(34.6)	14(60.9)	5(38.5)
Tenure Status			
Temporary	7(26.9)	1(4.3)	1(7.7)
Confirmed	18(69.2)	21(91.3)	10(76.9)
On Probation	1(3.8)	1(4.3)	2(15.4)
Designation			
Senior teacher 1	2(7.7)	7(30.4)	1(7.7)
Senior teacher 11	1(3.8)	13(56.5)	9(69.2)
Agric. Coordinator	21(80.8)	3(13.0)	3(23.1)
Others	2(7.7)	0(0)	0(0)
Specialization or subject taught by supervisor			
Agriculture	26(100)	23(100)	8(61.5)
Other subjects			5(38.5)

Table 2: Perceived effect of supervisor's specialization on supervision of agriculture teachers

Perception	**ATAS**					**ATNAS**				
	SA	**A**	**U**	**D**	**SD**	**SA**	**A**	**U**	**D**	**SD**
Accuracy in developing departmental goals	8(30.8)	17(65.4)	1(3.8)	0(0)	0(0)	11(47.8)	12(52.2)	0(0)	0(0)	0(0)
Proper and detailed departmental plan	11(42.3)	9(34.6)	5(19.2)	1(3.8)	0(0)	6(26.1)	3(13.0)	14(60.9)	0(0)	0(0)
Innovative and technical aspects of production in school	7(26.9)	12(46.2)	5(19.2)	2(7.7)	0(0)	9(39.1)	11(47.8)	3(13.0)	0(0)	0(0)
Efficiency in lesson plan preparation	9(34.6)	17(65.4)	0(0)	0(0)	0(0)	8(34.8)	11(47.8)	2(8.7)	1(4.3)	1(4.3)
Accuracy in budgeting for the agric vote	9(34.6)	16(61.5)	1(3.8)	0(0)	0(0)	2(8.7)	5(21.7)	9(39.1)	7(30.4)	0(0)
Continuity in the evaluation of agric projects	9(34.6)	13(50.0)	4(15.4)	0(0)	0(0)	2(8.7)	5(21.7)	8(34.8)	8(34.8)	0(0)
Planning and preparation of educational trips	1(3.8)	8(30.8)	12(46.2)	1(3.8)	4(15.4)	5(21.7)	5(21.7)	13(56.5)	0(0)	0(0)
Equitable distribution of garden resources	12(46.2)	11(42.3)	1(3.8)	2(7.7)	0(0)	5(21.5)	1(4.3)	9(39.1)	8(34.8)	0(0)
Proper management of agric equipment	6(23.1)	18(69.2	1(3.8)	1(3.8)	0(0)	7(30.4)	9(39.1)	7(30.4)	0(0)	0(0)
Implementation and management of projects	8(30.8)	16(61.5)	2(7.7)	0(0)	0(0)	2(8.7)	5(21.7)	9(39.1)	7(30.4)	0(0)
Guidance in use of teaching aids	7(26.9)	14(53.8)	5(19.2)	0(0)	0(0)	2(8.7)	10(43.5)	2(8.7)	7(30.4)	2(8.7)
Deliberations and time management during meeting	7(26.9	17(65.4)	2(7.7)	0(0)	0(0)	9(39.1)	13(56.5)	1(4.3)	0(0)	0(0)
Check if teachers prepare scheme of work	17(65.4)	9(34.6)	0(0)	0(0)	0(0)	9(39.1)	13(56.5)	1(4.3)	0(0)	0(0)
The teacher teach student centered lessons	10(38.5)	10(38.5)	4(15.4)	2(7.7)	0(0)	6(26.1)	9(39.1)	2(8.7)	4(17.4)	2(8.7)
Arouse the interest of students in the lesson	9(34.6)	14(53.8	3(11.5)	0(0)	0(0)	4(17.4)	9(39.1)	2(8.7)	6(26.1)	2(8.7)
Helped students to understand the importance of the lesson	9(34.6)	13(50.0)	4(15.4)	0(0)	0(0)	4(17.4)	8(34.8)	3(13.0	6(26.1)	2(8.7)
The teacher taught students at all levels of thinking	5(19.2)	14(53.8)	5(19.2)	2(7.7)	0(0)	2(8.7)	11(47.8)	3(13.4)	7(30.4)	0(0)

Table 3: The effect of supervision on job performance

Effect of supervision job performance	ATAS			ATNAS			supervisor		
	VE	E	NE	VE	E	NE	VE	E	NE
Teach students	4(15.4)	17(65.4)	3(11.5)	2(7.7)	4(17.4)	19(82.6)	11(84.6)	1(7.7)	1(7.7)
Prepare lesson plan	16(61.6)	9(34.6)	1(3.8)	7(30.4)	15(65.2)	1(4.3)	9(69.2)	4(30.8)	0(0)
Develop teaching aids	14(53.8)	12(46.2)	0(0)	6(26.1)	15(65.2)	2(8.7)	3(23.1)	8(61.5)	2(15.4)
Assign and mark work for students	9(34.6)	16(61.5)	1(8.7)	2(8.7)	13(56.5)	8(34.8)	8(61.5)	5(38.5)	0(0)
Compile term reports and annual plans	16(61.5)	8(30.8)	2(7.7)	5(21.7)	13(56.5)	5(21.7)	6(46.2.)	4(30.8)	3(23.1)
Attend departmental meetings	10(38.5)	16(61.5)	0(0)	5(21.7)	12(52.2)	6(26.1)	9(69.2)	4(30.8)	0(0)
Supervises students during practical	12(46.2)	14(53.8)	12(46.2	8(34.8)	2(8.7)	1(3.8)	9(69.2.)	2(15.4)	2(15.4)
Keep records of projects	13(50.0)	12(46.2)	1(3.8)	4(17.4)	4(17.4)	15(65.2)	6(46.2)	5(38.5)	2(15.4)
Manage garden tools properly	9(34.6)	14(53.8)	3(11.5)	3(13.0)	6(26.1)	14(60.9)	3(23.1)	7(53.8)	3(23.1.
Take text books inventory	11(42.3)	14(53.8)	1(3.8)	5(21.7)	3(13.0)	15(65.2)	7(53.8)	5(38.5)	1(7.7)
Prepare for agriculture fairs	2(7.7)	22(84.6)	2(7.7)	3(13.0)	3(13.0)	17(73.9)	5(38.5)	6(46.2)	2(15.4)
Follow schedule for feeding farm animals	11(42.3)	12(46.2)	3(11.5)	2(8.7)	5(21.5)	16(69.6)	7(53.8)	4(30.8)	2(15.4)
Take garden tools inventory	10(38.5)	12(46.2)	4(15.4)	1(4.3)	5(21.7)	17(73.9)	6(46.2)	4(30.8)	3(23.1
Take animal husbandry inventory	7(26.9)	16(61.5)	3(11.5)	3(13.0)	5(21.7)	15(65.2)	6(46.2)	4(30.8)	3(23.1)
Assess students practical work	5(19.2)	21(80.8)	00	3(13.0)	3(13.0)	17(73.9)	9(69.2)	2(15.4)	2(15.4)
Administer monthly tests	11(42.3)	12(46.2)	3(11.5)	6(26.1)	3(13.0)	14(60.8)	10(76.9	3(23.1)	0(0)
Set end of year examinations	19(73.1)	6(23.1)	1(3.8)	12(52.2)	10(43.5	1(4.3)	11(84.6)	2(15.4)	0(0)
Analyzes the examination results	19(73.1)	6(23.1)	1(3.8)	6(26.1)	15(65.2	2(8.7)	9(69.2)	4(30.8)	0(0)
Regular checking of departmental facilities	14(53.8)	11(42.3)	1(3.8)	6(26.1)	8(34.8)	9(49.1)	5(38.5)	5(38.5)	3(23.1)
Organize educational trips	5(19.2)	20(76.9)	1(3.8)	2(8.7)	4(17.4)	17(73.9)	4(30.8)	2(15.4)	7(53.8)
Take part in purchasing stock feed	5(19.2)	14(53.8)	7(26.9)	5(21.7)	18(78.3	0(0)	6(46.2)	7(53.8)	0(0)
Prepare scheme of work	8(30.8)	16(61.5)	2(7.7)	3(13.0)	4(17.4)	16(69.6)	9(69.2)	0(0)	0(0)
Fill in students' term and annual academic reports	15(57.7)	10(38.5)	3(11.5)	9(39.1)	8(34.8)	6(26.1)	6(46.2)	0(0)	0(0)
Monitor students attendance during practical	15(57.7)	8(30.8)	3(11.5)	7(30.4)	11(47.8)	5(21.7)	3(23.1)	0(0)	0(0)

Table 4: Job performance of agriculture teachers

Job performance	ATAS		ATNAS		Supervisor	
	Yes	No	Yes	No	Yes	No
Teach students	12(46.2)	14(53.8)	8(34.8)	15(65.2	12(92.3)	1(7.7)
Prepare lesson plans	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Monitor students attendance during practical	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Fill in term and annual academic reports	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Attend departmental meetings	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Supervises students during practical	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Keep records of projects	26(100)	0(0)	23(100)	0(0)	13(100)	0(0)
Take book inventory	26(100)	0(0)	23(100)	0(0)	12(92.3)	1(7.7)
Prepare for agriculture fair	24(92.3)	2(7.7)	19(82.6)	4(17.4)	13(100)	0(0)
Follow schedule of feeding farm animals	24(92.3)	2(7.7)	18(78.3)	5(21.7)	13(100)	0(0)
Take garden tools inventory	25(96.2)	1(3.8)	22(95.7)	1(4.3)	12(92.3)	1(7.7)
Manage garden tools properly	25(96.2)	1(3.8)	19(82.6)	4(17.4)	12(92.3)	1(7.7)
Set monthly and end of year examination	26(100)	0(0)	22(95.7)	1(4.3)	13(100)	0(0)
Take part in purchasing stock feed	26(100)	0(0)	23(100)	0(0)	11(84.6)	2(15.4)
Analyse examination results	26(100)	0(0)	21(91.3)	1(8.7)	9(69.2)	4(30.8)
Organise educational trips	25(96.2)	1(3.8)	16(69.6)	7(30.4)	8(61.50	5(38.5)
Prepare scheme of work	20(76.9)	6(23.1)	16(69.6)	7(30.4)	13(100)	0(0)

Table 5: Roles of agricultural science teachers' supervisors

Supervisory roles	VE	E	NE
Working with teachers to develop strategies for improving student performance	5(38.5)	7(53.8)	1(7.7)
Submitting departmental plans to be included in the school master plan	7(53.8)	6(46.2)	0(0)
Work with teachers to draw departmental plans	5(38.5)	6(46.2)	2(15.4)
Communicate the needs of the department to the management of the school	9(69.2)	4(30.8)	0(0)
check if teachers prepare lesson plans	2(15.4)	7(53.8)	4(30.8)
Check if teachers assess students	4(30.8)	7(53.8)	2(15.4)
Conduct lesson observations	11(84.6)	2(15.4)	0(0)
Organizing induction workshop for new teachers	1(7.7)	3(23.1)	9(69.2)
Identifying teachers training needs	1(7.7)	1(7.7)	11(84.6)

Delegating responsibilities to teachers	2(15.4)	6(46.2)	5(38.5)
Making follow up on resolutions made in meetings	4(30.8)	4(69.2)	0(0)
Convening departmental meetings	4(30.8)	5(38.5)	4(30.8)
encourage teachers to attend classes on time	6(46.2)	4(30.8)	3(23.0)
Analyzing the examination results with teachers	11(84.6)	2(15.4)	0(0)
Influencing teachers to accept change	6(46.2)	7(53.8)	0(0)

Table 6: One way analysis of variance showing difference in the effect of supervision and job performance among ATAS, ATNAS and Supervisors

Variables		Sum of Squares	df	Mean Square	F	Sig.	Groups	N	Means
Perceived effect of supervision	Between Groups	4677.479	2	2338.740	27.93	0.00	SupV	13	34.07[a]
	Within Groups	4940.408	59	83.736			ATAS	26	39.76[a]
	Total	9617.887	61				ATNAS	23	55.30[b]
Job performance	Between Groups	30.026	2	15.013	3.76	0.03	SupV	13	18.84[a]
	Within Groups	235.344	59	3.989			ATAS	26	18.00[a b]
	Total	265.371	61				ATNAS	23	19.56[b]

Table7: t-test analysis showing differences between ATAS and ATNAS on effect of supervision and job performance

	Groups	N	Mean	SD	SEM	t	df	p
Supervisors' specialization	ATAS	26	47.69	8.65	1.69	14.97	38	0.00
	ATNAS	23	18.78	4.42	0.92			
Effect of supervision on performance	ATAS	26	39.76	6.55	1.28	-5.98	35	0.00
	ATNAS	23	55.30	10.82	2.25			
Job performance	ATAS	26	18.00	0.89	0.17	-3.00	27	0.006
	ATNAS	23	19.56	2.35	0.49			

Discussion

From Table 1, majority of agriculture teachers those supervised by agriculture supervisors (ATAS) and non-agriculture supervisors (ATNAS) (65 and 56 percent respectively) and their supervisors 84 percent are male. The results indicate that males dominate in all the categories and might be due to past experience where anything related to agriculture was considered dirty and labour intensive thus suitable only for men. Therefore, they were favored by enrolling in agriculture education early where priority was given to men. In terms of age, while the supervisors' age is at least 31 years, majority of the teachers are less than 31 years. Leadership positions in Botswana junior secondary schools are held relatively by young professionals. Majority of agriculture teachers have diploma in Education (69.2%) because they are suited by entry requirement at diploma level but with long years of service. According to the results, 77 percent of the supervisors have teaching experience, ranging from 5 – 10 years, which is followed by 52% for ATAS and 46% for ATNAS. A study by Nkabule (1998) also found that teaching experience explained supervision effectiveness by agriculture coordinators in Swaziland. The Teaching Service Management unit in Botswana recommended that a teacher should have served for a minimum of two years in a post before he/she is promoted, (TSM, 1994) and promotion is based on Performance Based Reward System (PBRS) which is based on job performance. As a result teachers are mostly employed on permanent and pensionable basis as revealed by the results, 91.3% of ATNAS are confirmed including (76.9%) supervisors and 69.2% of ATAS.. In addition, probation period has been reduced from two years to one year. Parallel progression has automatically moved teachers from teacher post to senior teacher II with (69.2%) supervisors and (56.5% of ATNAS. Senior teacher I position has less number of teachers where teaching experience is required. Majority of agriculture teachers are coordinators (80.8%). Agriculture supervisors delegate responsibility to agriculture teachers as a way of developing them. Due to localization, large numbers (100%) of agriculture teachers are Batswana and 18.5% are expatriates specializing in other subjects yet supervising agriculture teachers. These characteristics would influence the professional roles of the teachers (Pajak and Blasé, 1989). This is in line with the TSM (1994) main objective of teachers education "to expand the supply of qualified Batswana teachers at both primary and secondary school levels and to ensure that staff are well motivated and effective."

Perception of the supervisor's specialization on supervision of agriculture teachers

To describe the perception of the supervisor's specialization on supervision of agriculture teachers, the results show that 65.4% of ATAS agreed that their heads of department are accurate in developing departmental goals, 65.4% perceive that the supervisors are efficient in lesson plan preparation, proper in management of agriculture equipment (69.2%) and check if teachers prepare scheme of work (65.4%). This is possible since supervisors are in their area of specialization. Furthermore, the results indicates that (52.2%) of ATNAS agreed that they are accurate in developing departmental goals, (39.1%) strongly agree that they are innovative and have technical aspects of production in school, agree that supervisors are good in deliberations and time management during meetings (56.5%), and (56.5%) agree that the supervisors check if teachers prepare scheme of work. Non agriculture supervisors are mostly Science or Mathematics teachers who always aim higher and make sure that they achieve their departmental goals. As a result they will make sure that agriculture departmental goals are developed and implemented. Agriculture is a science related subject and it is possible for the supervisors to apply science techniques in schools. A higher proportion of the supervisors who have the same subject specialization perform their supervisory roles that supervisors who do not specialize in the same subjects. The findings from the study were consistent with findings by Nkambule and Dlamini (1998) who reported that Head of agriculture in Swaziland were ineffective in supervising agriculture teachers. Their study revealed that the head of agriculture department failed to conduct lesson observations in order to evaluate the performance of teachers.

Effect of Supervision on job performance

The results indicated that the proportion of ATNAS that are not effective in teaching students (82.6%) which is the core business is higher than the ATAS. In addition, the percentage of agriculture teachers supervised by agriculture supervisors that are effective in preparing for agriculture fairs (84.6%), effective in assessing students practical work (80.8%), effective in organizing educational trips (76.9%), very effective in filling students term and annual academic reports (57.7%) and monitoring students attendance during practical (57.7%) are more than teachers supervised by non agriculture supervisors that are not effective in preparing for agriculture fairs (73.9%), assessing students practical work (73.9%) taking garden tools inventory (73.9%) and organizing educational trips. The results show that these teachers are effective in setting end of year examination (52.2%) and also effective in taking part in purchasing stock feed (78.3%). Supervisors on the other hand are very effective in teaching students (84.6%), effective in developing teaching aids (61.5%) and managing garden tools (53.8%). In addition they are very effective in administering monthly tests (76.9%), set end of year examinations (84.6%) and not effective in organizing educational trips (53.8%). Agriculture teachers supervised by non agriculture teachers are generally not effective in performing some duties like teaching students due to biasness of supervisors who give more time and attention to their areas of specialization. Agriculture teachers supervised by agriculture supervisors are effective in all their duties. All categories are effective in lesson planning since it is one of the requirements recommended for annual increment upon assessment. Teachers are also expected to accompany students when travelling or on educational trip According to the findings, teachers supervised by non agriculture supervisors were not performing satisfactorily as teachers supervised by agriculture supervisors. Teaching Service Management (1994) stated that any person promoted to head of department must have acquired experience which should be demonstrated in both teaching and administrative skills, not taking into consideration subject specialization.

Agriculture teachers' job performance

The results of job performance among ATAS and ATNAS is presented in Table 4. This is due to the fact that Walker and Kitchel (2004) studied job satisfaction and retention of secondary school teachers and found lack of support from supervisors led to job dissatisfaction and teachers leaving the service. Supervisors are supposed to provide opportunities for teachers to feel more adequate as professionals to see greater significance, possibilities and responsibilities in their role. Supervisors focus on planning, communicating the needs of teachers to the management, giving feedback to teachers and evaluating performance of teachers through in - service training and motivate teachers for better performance in schools. The results shows that (96%) of ATAS, (69.2%) of ATNAS and (61.5%) supervisors analyzed examination results. Preparation of scheme of work is done by, ATAS (76.9%), ATNAS (69.6%) and supervisors (100%). Performance Management System is a motive behind teachers working hard because nomination for promotion is based solely on hard work. Supervisors are also urged to perform to be selected for further studies or any other promotion. Castle, (2006) stressed the need for the use of performance based assessment for promotion of teachers.

Supervisory roles

In Table 5, supervisors rated their effectiveness in their roles. The result shows that supervisors are very effective in communicating the needs of the department to the management of the school (69.2%), very effective in conducting lesson observations (84.6%). They are also very effective in analyzing examination results with teachers (84.6%) and making follow up on the resolutions made in meetings ((69.2%). This is to the supervisors' advantage because if they perform or not determines whether one is promoted to higher posts or not. The results show that supervisors are not effective in organizing induction workshop for new teachers (69.2%) and identification of teachers training needs (84.6%) which is in agreement with the findings of Dlamini (2004) from Swaziland. It is the responsibility of Teacher Training and Development to identify teachers training needs but supervisors might give a helping hand if need be.

Table 6 presents the results showing difference in the effect of supervision and job performance among ATAS, ATNAS and Supervisors. Significant differences exist in the perceived effect of supervision ($F = 27.93$, $p < 0.05$) and job performance ($F = 3.76$, $p < 0.05$). ATNAS has the highest means of 55.30 indicating that they perceived that supervisors' specialization has impact on the supervision. However, there is no difference in the mean scores of ATAS and supervisors (SupV). It then implies that in order to improve the quality of supervision, supervisors should be in the same subject specialization with the teachers they supervise. Similarly, ATNAS has the highest means for job performance (19.56) and no difference in the mean scores of ATAS and supervisors (SupV) exist. This may be due to the fact that the ATNAS in an attempt to measure up to the standard has to cover many activities and thus a high means score for job performance.

The results of the t-test analysis showing differences between ATAS and ATNAS on effect of supervision and job performance are presented in Table 7. Significant differences exist between ATAS and ATNAS for the 3 variables. Supervisors' specialization ($t = 14.97$, $p < 0.05$), effect of supervision on performance ($t = -5.98$, $p < 0.05$) and job performance ($t = -3.00$, $p < 0.05$). For Supervisors' specialization, ATAS has higher mean 47.69 which implies that supervisors should be in the same subject specialization with the teachers they are supervising. With respect to effect of supervision on performance, ATAS agreed that supervision based on subject specialization through supervisors would affect the teachers more than the general principle of supervision. Cooper (1984) stressed the need for the development of skills for instructional supervision. In terms of job performance, ATNAS has higher mean indicating at that ATNAS has to do a lot more activities to be able to measure up to required standard due to non-subject based supervision. Teaching supervisory roles is males dominate leadership positions in Botswana junior secondary schools and the supervisors comprised of married, young professionals who had bachelor's degree. Majority of ATAS and ATNAS indicated that a higher proportion of the supervisors who have the same subject specialization perform their supervisory roles that supervisors who do not specialize in the same subjects. Also, the proportion of ATNAS that are not effective in job activities is higher than the ATAS. However job performance is higher among ATNAS than ATAS and supervisors are not very effective on subject specific supervisory activities rather the general principle of supervision. Significant differences exist in the perceived effect of supervision and job performance among ATAS, ATNAS and Supervisors. Also between ATAS and ATNAS, significant differences exist between ATAS and ATNAS for supervisors' specialization, effect of supervision on performance and job performance. It then implies that in order to improve the quality of supervision, supervisors should be in the same subject specialization with the teachers they supervise as such would help would affect the teachers more than the general principle of supervision.

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Minimum Cost-Reliability Ratio Path Problem

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Abstract: *The problem of finding a minimal cost-reliability ratio path is considered. The optimal solution to this problem is shown to map into an extreme supported non-dominated objective point in the objective space of the biobjective shortest path problem. Different forms of reliability are presented. We assume that this reliability does not change over time. We employ a parametric network simplex algorithm to compute all extreme supported non-dominated objective points. A sufficiency conditions introduced by Ahuja [1] are used to reduce the path enumeration. Our algorithm is based on the method of Sedeño-Noda and González-Martín. A numerical example is provided to illustrate the algorithm.*
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Keywords: biobjective shortest path problem; extreme efficient solution; extreme non-dominated solution.

1 Introduction

Suppose that the network is described by a connected, directed graph $G(V,E)$, where $V=\{1,2,\dots,n\}$ is the node set and $E=\{e=(i,h): i,h\in V\}$ is the edge set. The nodes are assumed to be perfectly reliable. Associated with each edge $e\in E$ are two attributes. The first attribute is the edge cost c_{ij}. The second attribute is the probability $0<p_{ij}<1$, that when attempting to traverse edge (i,j) it is found in an operational state. The reliability measures the probability that the edge will be operational. The reliability of a directed path is de.ned as the product of the reliability of edges in the path $[i.e.,\ R(P)=\prod_{(i,j)\in P} p_{ij}]$. We assume that this probability does not change over time.

Let s and t be two given and distinguished nodes of $G(V,E)$. A path P from s to t in $G\ (V,E)$ or simply path is a sequence of non-repeated nodes and connecting arcs, joining the initial node s to the terminal node t. We consider the problem of determination of a directed path P from a source node s to a destination node t for which

$$\frac{\sum_{(i,j)\in P} c_{ij}}{\prod_{(i,j)\in P} p_{ij}}$$

is minimum among all such paths. We refer to this problem as the Minimum Cost -Reliability Ratio Path Problem (MCRRPP) [1].

Ahuja [1] observed that the optimum solution of the MCRRPP is an efficient extreme solution of the bicriterion path problem. He employed the parametric programming to enumerate these efficient extreme solutions and a sufficiency condition is used to cut down the enumeration substantially. The algorithm is shown to be pseudo-polynomial. Chandrasekaran [6] provided a polynomial bounded algorithm to solve minimal ratio spanning trees. Chandrasekaran et al. [7] presented a polynomial algorithm consisting of an indirect search in the set of efficient extreme points for computing the solution to the cost-reliability ratio spanning tree problem. Aneja and Nair [3] considered a finite serial multistage system where the measure of effectiveness of the system is a ratio of two return functions. The numerator of the ratio is an additive return function whereas the denominator is a multiplicative one. They considered two-criterion dynamic program and showed that the optimal solution of the ratio dynamic program is a non-dominated solution of the two criteria program. Martins [12] presented a polynomial algorithm to determine a path between a specified pair of nodes, which minimizes the cost/capacity ratio.

This paper is organized as follows. Section 2 presents concepts, definitions and problem properties. In Section 3, we present an algorithm to solve MCRRPP. A numerical example is presented in Section 4. In Section 5 we conclude with some comments.

2 The problem and Properties

Let Φ be the set of all directed paths in $G(V,E)$ from the source s to the destination t. For each $P\in\Phi$ define

$$\begin{aligned} C(P) &= \sum_{(i,j)\in P} c_{ij} \\ R(P) &= \prod_{(i,j)\in P} p_{ij} \qquad (1) \\ D(P) &= \sum_{(i,j)\in P} d_{ij} \end{aligned}$$

where, $d_{ij}=-\ln p_{ij}$, $0<p_{ij}\le 1$ then $d_{ij}>0$, $\forall (i,j)\in E$ and $R(P)=\prod_{(i,j)\in P} p_{ij}=e^{-\sum_{(i,j)\in P} d_{ij}}$ for all $P\in\Phi$ which means that $R(P)=e^{-D(P)}$.

Now the problem we consider is

$$\min_{P\in\Phi} z(P) = \frac{C(P)}{R(P)} = C(P)e^{D(P)} \quad (2)$$

Associated with (2), we define the biobjective shortest path (BSP) problem as follows:

$$\min_{P\in\Phi}[C(P), D(P)] \quad (3)$$

and

$$\min_{P\in\Phi}[C(P), -R(P)] \quad (4)$$

The mathematical programming formulation of the BSP (3) is

$$\min F(x) = \begin{cases} f_1(x) = \sum_{(i,j)\in P} c_{ij}x_{ij} \\ f_2(x) = \sum_{(i,j)\in P} d_{ij}x_{ij} \end{cases} \quad (5)$$

$$s.t.$$

$$\sum_{\{j:\,(i,j)\in E\}} x_{ij} - \sum_{\{j:\,(j,i)\in E\}} x_{ji} = \begin{cases} 1 & if\ i = s \\ 0 & if\ i \neq s,t \\ -1 & if\ i = t \end{cases}$$

$$x_{ij} \in \{0,1\}, \forall (i,j) \in E$$

where s is the designated source node and t is the designated terminal node. Let X be the set of all feasible solutions to (5) and it is also called the feasible set in the decision space. So, the problem (5) can be stated as follows:

$$\min F(x) = \big(f_1(x), f_2(x)\big) \quad (6)$$
$$s.t.\ x \in X$$

Now, we introduce general definitions and a classification of efficient solutions. We will follow the terminology of Raith and Ehrgott [24], Eusébio and Figueira [13], Raith and Ehrgott [25], and Hamacher et al. [18].

Definition 1 A feasible solution $\tilde{x} \in X$ is called efficient if there does not exist any $x \in X$ with $\big(f_1(x), f_1(x)\big) \leq \big(f_1(\tilde{x}), f_2(\tilde{x})\big)$ and $\big(f_1(x), f_2(x)\big) \neq \big(f_1(\tilde{x}), f_2(\tilde{x})\big)$. Otherwise x is inefficient.

Let C be $p \times n$ criterion matrix whose rows are the c^i, the composite objective function is written $\lambda^T Cx$. The following theorem shows that the set of efficient solutions in X can be obtained by solving a parametric problem.

Theorem 1 $x \in X$ is efficient if and only if there exists

$$\lambda \in \Omega = \left\{\lambda \in R^p : \lambda_i > 0, \sum_{i=1}^{p} \lambda_i = 1\right\}$$

such that x minimizes the weighted-sum linear programming problem $\min\{\lambda^T Cx : x \in X\}$ (see [13] and [29], p.215).

Efficiency is defined in the decision space. There is a natural counterpart in the objective space. The objective space is denoted by Y and is given by

$$Y = \{F(x) \in R^2 : F(x) = \big(f_1(x), f_2(x)\big), x \in X\}$$

Definition 2 $F(x) \in Y$ is a non-dominated (ND) point if and only if x is an efficient solution to (6). Otherwise $F(x)$ is a dominated point.

Let $X_E \subseteq X$ be the set of all efficient solutions of the BSP (6) and $Y_{ND} \subseteq Y$ be the set of all ND objective points. We distinguish two different types of ND objective points, supported and non-supported ND objective points. Let

$$Y^{\geq} = conv(Y_{ND}) + R_{\geq}^{p}$$

where $conv$ is the convex hull operator and $R_{\geq}^{p} = \{y \in R^p : y \geq 0\}$ is the Pareto cone and $conv(Y_{ND}) + R_{\geq}^{p} = \{y \in R^p : y = y' + y'', y' \in conv(Y_{ND}), y'' \in R_{\geq}^{p}\}$. The non-dominated frontier of Y is defined as the set [see Ehrgott [22] and Hamacher et al. [18]]

$$\left\{y \in conv(Y_{ND}) : conv(Y_{ND}) \cap \left(y + \left(-R_{\geq}^{p}\right)\right) = \{y\}\right\}$$

Definition 3 (Supported ND solution Y_{SN}). Let y denote an ND objective solution. Then, if y belongs to the efficient frontier of Y, y is a supported ND objective solution. Otherwise, y belongs to the interior of $Y^{\geq}$ and it is a non-supported ND objective solution.

The efficient frontier is piecewise linear and convex. Its breakpoints are the extreme ND objective points which are images of extreme efficient solutions in the decision space.

Definition 4 (Extreme supported ND solution Y_{XSN}). Let $y \in Y_{SN}$. Then, y is an extreme supported solution if it is an extreme point of $Y^{\geq}$. Otherwise, y is a non-extreme supported solution.

All supported ND objective points are located on the "lower-left boundary" of $conv(Y_{ND})$, *i.e.* they are ND points of $Y^{\geq}$. The supported and the non-supported efficient solutions are defined to be the inverse images of the supported and the non-supported of ND objective points. They can be distinguished as follows:

- Supported efficient solutions are those efficient solutions that can be obtained as

optimal solutions to a (single objective) weighted sum problem

$$\min_{x \in X} \lambda f_1(x) + (1-\lambda) f_2(x) \qquad (7)$$

for some $\lambda > 0$. The set of all supported efficient solutions is denoted by X_{SE}, its non-dominated image is Y_{SN}.

- Supported efficient solutions which define an extreme point of $Y^{\geq}$ are called extreme supported efficient solutions and is denoted by X_{XSE}.
- The remaining efficient solutions in $X_{NE} := X_E \backslash X_{SE}$ are called non-supported efficient solutions. They cannot be obtained as solutions of a weighted sum problem as their images lie in the interior of $Y^{\geq}$. The set of non-supported non-dominated points is denoted by Y_{NN}. Note that this definition implies $Y_{NN} \subset int\left(conv(Y_{ND}) + R_{\geq}^{p}\right)$. There is no known characterization of non-supported efficient solutions that leads to a polynomial time algorithm for their computation.

The two objective functions f_1 and f_2 do generally not attain their individual optima for the same values of $\tilde{x}$. We will assume in the following that there exists no $\tilde{x}$ such that $\tilde{x} \in \arg\min\{f_1\}$ and $\tilde{x} \in \arg\min\{f_2\}$ for a problem of the form (5).

The solution of the BSP contain both non-supported and supported non-dominated vectors / efficient solutions, which can be geometrically characterized as follows: the non-supported non-dominated vectors are located inside the feasible region in the objective space, while the supported vectors are found on the boundaries of the convex hull of this feasible region. Supported non-dominated vectors correspond to the optimal solutions of a sequence of single objective parametric network flow problems.

All the previous terminology can be summarized in Table 1.

Table 1: Classification of efficient and non-dominated in the decision and objective spaces

Decision Space	Objective Space
X: set of all feasible solutions	$Y = F(X)$: image of X under the objective function (objective space)
X_E: set of all efficient solutions	Y_{ND}: set of all non-dominated objective solutions
$X_{SE} \subseteq X_E$: set of all supported efficient solutions	$Y_{SND} \subseteq Y_{ND}$: set of all supported non-dominated objective solutions
$X_{XSE} \subseteq X_{SE}$: set of all extreme supported efficient solutions	$Y_{XSND} \subseteq Y_{SND}$: set of all extreme supported non-dominated objective solutions
$X_{NE} := X_E \backslash X_{SE}$: set of all non-supported efficient solutions	$Y_{NND} \subseteq Y_{ND} \backslash Y_{SND}$: set of all non-supported non-dominated objective solutions

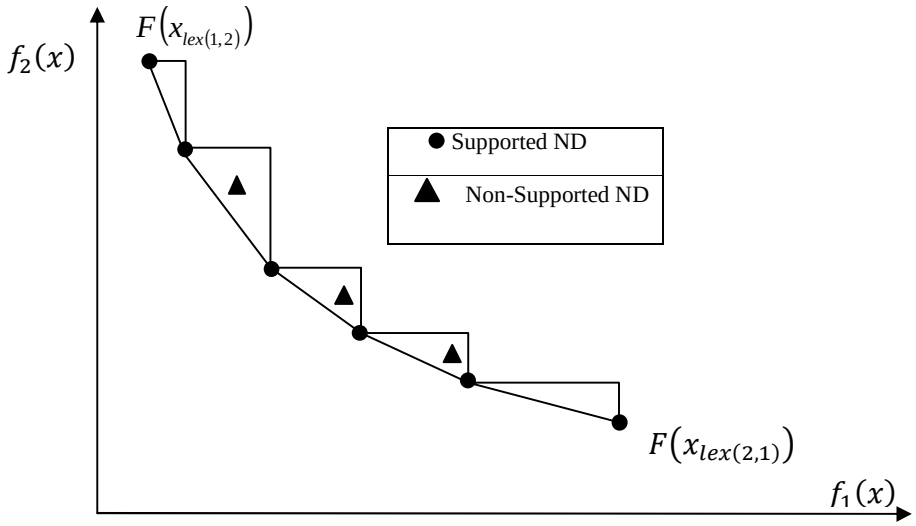

Figure 1: All non-dominated points in the objective space

Theorem 2 An optimal solution P^* of the MCRRPP maps into a supported extreme non-dominated point of $conv(Y)$.

Proof As we mentioned above $R(P) = e^{-D(P)}$: It easy to see that the optimal solution P^* of the MCRRPP maps into a non-dominated objective point of (3). Otherwise, let $\tilde{P}$ such that $C(\tilde{P}) < C(P^*)$ and $D(\tilde{P}) < D(P^*)$ with strict inequality holding at least at one of these two places. This implies

$$\frac{C(\tilde{P})}{e^{-D(\tilde{P})}} < \frac{C(P^*)}{e^{-D(P^*)}}$$

since $C \geq 0$. That is

$$\frac{C(\tilde{P})}{R(\tilde{P})} < \frac{C(P^*)}{R(P^*)}$$

which contradict the optimality of P^*.

Suppose that P^* maps into $y^* \in conv(Y) + R^2_{\geq}$. We want to show that y^* is an extreme point of $Y^{\geq}$. Suppose the contrary, y^* is not an extreme point of $Y^{\geq}$. Then there exist two extreme points y^1 and y^2 (corresponding to two efficient extreme paths P^1 and P^2), such that $y^* = \alpha y^1 + (1-\alpha)y^2; 0 < \alpha < 1$, where

$$y^1 = \big(C(P_1), D(P_1)\big)$$
$$y^2 = \big(C(P_2), D(P_2)\big)$$

and

$$y^* = \big(C(P^*), D(P^*)\big)$$

Assume that

$$\frac{C(P_1)}{R(P_1)} = m_1 \leq \frac{C(P_2)}{R(P_2)} = m_2$$

Now,

$$D(P^*) = \alpha D(P_1) + (1-\alpha)D(P_2)$$

and by convexity of e^{-x}, we have

$$e^{-D(P^*)} = e^{-(\alpha D(P_1)+(1-\alpha)D(P_2))} < \alpha e^{-D(P_1)} + (1-\alpha)e^{-D(P_2)} = \alpha\frac{C(P_1)}{m_1} + (1-\alpha)\frac{C(P_2)}{m_2} = \frac{[\alpha C(P_1) + (1-\alpha)C(P_2)]}{m_1} = \frac{C(P^*)}{m_1}$$

That is, $\frac{C(P^*)}{R(P^*)} > m_1$, contradicting the optimality of P^* ■

The problem, thus, reduces to searching through shortest paths which correspond to non-dominated extreme points of the set $Y^{\geq}$ in the biobjective space.

Definition 5 A function $f: S \subseteq R \to R$ is unimodal on an interval S if there exists a $x^* \in S$ at which f attains a minimum and f is nondecreasing on the interval $\{x \in S: x \geq x^*\}$ whereas it is nonincreasing on the interval $\{x \in S: x \leq x^*\}$.

It is well known that the efficient frontier obtained by joining the points P_{k-1} to P_k for all $k = 2, \dots, w$, is a piecewise linear convex function and typically is of the form as shown in Fig. 1. Let $P_1, P_2, \dots, P_w$ be the set of all ND extreme points of (3) in the increasing order of their $D(P_i)$ value. Let $C_{min} = C(P_w)$ and $C_{max} = C(P_1)$. Further, let L_k denote the line passing through P_{k-1} and P_k. The equation of L_k is given by $y = a_k - b_k x$, where $b_k = \frac{D(P_k)-D(P_{k-1})}{C(P_{k-1})-C(P_k)}$ and $a_k = D(P_k) + b_k C(P_k)$. For any point $(x, y) \in L_k$ define $h_k(x) = xe^y = xe^{a_k - b_k x}$. It is easy to see that $h_k(x)$ is a unimodular function and achieves its maximum at $x^* = \frac{1}{b_k}$.

Let $x_i = C(P_i), \forall i = 1, 2, \dots, w$. Further, let

$$z_k^* = \min_{1 \leq i \leq k}\{z(P_i)\}$$

and P^* be the path for which this minimum is attained.

Theorem 3 If $h_k(C_{min}) \geq z_k^*$, then P^* is an optimum solution of the MCRRPP.

Proof Since the efficient frontier is piecewise linear and convex, it follows that $a_k - b_k x_i < D(P_i), \forall\, i = k+1, k+2, \dots, l$, then

$$h_k(x_i) = x_i e^{a_k - b_k x_i} < C(P_i)e^{D(P_i)} = z(P_i), \forall\, i = k+1, \dots, l$$

Since the function $h_k(x)$ achieves its maximum at $x = \frac{1}{b_k}$, so we consider two cases, the first case when $x_k \leq \frac{1}{b_k}$, and by the nature of the function $h_k(x)$

$$z_k^* \leq h_k(C_{min}) \leq h_k(x_i) < z(P_i), \quad \forall i = k+1, k+2, \dots, m$$

The second case when $x_k > \frac{1}{b_k}$, let $\tilde{x}_k$ be such that $h_k(x_k) = h_k(\tilde{x}_k)$

$$z_k^* \leq h_k(C_{min}) \leq h_k(x_k) \leq h_k(x_i), \quad \forall \tilde{x}_k \leq x_i \leq x_k$$

and the proof is complete ■

The paths are enumerated in the order $P_w, P_{w-1}, \dots, P_1$ by the parametric analysis which we are going to explain in Section 4. We can use the following condition as a termination condition. Let $\tilde{P}^*$ be the minimum of $\tilde{z}^* = \min_{k \leq i \leq w}\{z(P_i)\}$.

Theorem 4 If $h_{k+1}(C_{max}) \geq \tilde{z}_k^*$, then $\tilde{P}^*$ is an optimum solution of the MCRRPP

Proof The proof is similar to the previous Theorem ■

2.1 A different measure for reliability

In this section we are presenting different measure for the reliability of a path $R(P) = \prod_{(i,j)\in P} p_{ij}$. We assume that this probability does not change over time. Although there are no limitations regarding the number of edges that can be in a failed state, we assume that failures occur independently and they are unrecoverable. Reliability of a path refers to the probability of traversal, *i.e.*, the probability that all edges along the path are operational. We model the operational probability of an edge as an exponential function of physical distance. A realistic assumption regarding p_{ij} is that failures that prohibit the use of the edge for traversal are generated according to a Poisson process with constant rate $\lambda_{ij}, (i,j) \in E$, modeling p_{ij} as an exponential function of the physical distance. The failure rate λ_{ij} represents the average number of failures per unit length. We represent the relationship between edge lengths, operational probability and failure rate, using the exponential model introduced by Melachrinoudis and Helander [19], as $p_{ij} = e^{-\lambda_{ij} d_{ij}}$.

Suppose we know for each edge $(i,j) \in E$ its failure rate λ_{ij} and distance d_{ij}. The operational probabilities are calculated by using the exponential model $p_{ij} = e^{-\lambda_{ij} d_{ij}}$. We use the logarithmic transformation between operational probability and edge length, which was proposed by Melachrinoudis and Helander [19], to calculate for each edge $(i,j) \in E$ the "artificial" edge length $d_{ij}^A = -\ln p_{ij} = \lambda_{ij} d_{ij}$ and to define a new network $\breve{G}(V,E)$ with the same sets of edge attributes costs, c_{ij} and operational probabilities, $p_{ij} = e^{-d_{ij}^A}$ but its edge distances are $d_{ij}^A, (i,j) \in E$. Due to the logarithmic transformation, the most reliable route between nodes i and j on $G(V,E)$ is the shortest path between nodes i and j on $\breve{G}(V,E)$.

Let Φ be the set of all directed paths in $\breve{G}(V,E)$. For each $P \in \Phi$ define

$$C(P) = \sum_{(i,j)\in P} c_{ij}$$

$$\breve{R}(P) = \prod_{(i,j)\in P} p_{ij}$$

$$\breve{D}(P) = \sum_{(i,j)\in P} d_{ij}$$

where, $d_{ij}^A = -\ln p_{ij}$, $0 < p_{ij} \le 1$ then $d_{ij}^A > 0$, $\forall (i,j) \in E$ and $\breve{R}(P) = \prod_{(i,j)\in P} p_{ij} = e^{-\sum_{(i,j)\in P} d_{ij}^A}$ for all $P \in \Phi$ which means that $\breve{R}(P) = e^{-\breve{D}(P)}$.
Now, the problem we consider is

$$\min_{P\in\Phi} z(P) = \frac{C(P)}{\breve{R}(P)} \qquad (8)$$

Associated with (8) we define the following biobjective shortest path (BSP) problem

$$\min_{P\in\Phi} \left[C(P), \breve{D}(P)\right] \qquad (9)$$

and

$$\min_{P\in\Phi} \left[C(P), -\breve{R}(P)\right]$$

Theorem 5 An optimal solution P^* of the problem (8) maps into a supported extreme non-dominated point of (9).
Proof Similar to Theorem 1

Theorem 6 If all edge failure rates are equal, the optimal solution P^* of (2) is the same as the optimal solution of (8)
Proof Let $\lambda_{ij} = \lambda,\ \forall (i,j) \in E$. The network $\breve{G}(V,E)$ has the same topology as $G(V,E)$ and its edge lengths have been scaled by λ, *i.e.*, $d_{ij}^A = \lambda d_{ij}$. Let P^* be the optimal solution of the problem $\min_{P\in\Phi} z(P) = \frac{C(P)}{\breve{R}(P)}$. Since $\breve{D}(P) = \sum_{(i,j)\in P} d_{ij}^A = \sum_{(i,j)\in P} \lambda d_{ij} = \lambda D(P)$, hence, $\min_{P\in\Phi} \frac{C(P)}{\breve{R}(P)} =$
$\min_{P\in\Phi} \frac{C(P)}{e^{-\breve{D}(P)}} = \min_{P\in\Phi} \frac{C(P)}{e^{-\lambda D(P)}} = \min_{P\in\Phi} \frac{C(P)}{(R(P))^{\lambda}}$,
which proves that P^* is also the optimal solution of $\min_{P\in\Phi} \frac{C(P)}{R(P)}$ ■

Table 2: Classification of BSP algorithms and references

Two Phase Method	Path/tree	Mote et al. [16]
Biobjective Label Correcting	Node-selection	Skriver and Andersen [27], Brumbaugh-Smith and Shier [4]
Biobjective Label Setting	Label-selection	Hansen [10]
Kth Shortest Path	Ranking	Clímaco and Martins [8]
Near Shortest Path	Ranking	Carlyle and Wood [5]

3 Solution Method

3.1 A brief review of solution methods for the BSP problem

In this section we give a brief review of different methods to solve BSP exactly. Three main approaches are considered. The two phase method, the biobjective labeling methods, and ranking methods. Climaco and Martin [8] and Mote et al. [16] fall in the path/tree handling procedure. Hansen [10], Brumbaugh-Smith and Shier [4] and Skriver and Andersen [27] fall in the labeling procedure.

In table 2 the references that fall in the main approaches to solve BSP are listed.

Our review is based on Skriver [26] and Raith and Ehrgott [25]

1) Two phase method
   In the existing literature all algorithms, except perhaps the Parametric Approach by Mote et al. [16], have been proven slower than the Label Correcting approach [27]. In phase I, all the extreme supported efficient solutions (efficient solutions which define extreme points of the convex hull of the set of feasible objective vectors) are computed. In the second phase the remaining efficient solutions are computed with one of the enumerative approaches mentioned before. The enumerative methods can be employed in a very effective way as enumeration can be restricted to small areas of the objective space [see [25]].
2) Biobjective label correcting
   Label correcting differs in whether they employ label-selection or node-selection. Skriver and Andersen [27] have claimed that the node-selection algorithms outperform the path/tree algorithms (two phase method) because the number of non-dominated values is always smaller than (or equal to) the number of efficient paths. A stronger argument is that the node-labeling algorithm only finds the list of non-dominated values at the terminal node, and not the actual efficient paths.
3) Biobjective label setting
   Biobjective label setting approaches always employ label-selection. In particular, a lexicographically smallest label with respect to all nodes is selected among all tentative labels in each iteration. Guerriero and Musmanno [9] investigated label correcting and label setting methods for the multicriteria shortest path tree problem. There are problem instances where label-selection is superior and others where node-selection is superior. Furthermore, label setting is superior for some instances, and label correcting is superior for others.
4) Ranking methods
   Starting with the optimal value for one objective, the second-best solution, the third-best solution, etc. is obtained until the *k*-best solution is reached. For BSP, the process continues until it is guaranteed that all non-dominated points have been found. *K*th shortest path methods have been found not to be competitive with label correcting methods. On the basis of computational tests, Carlyle and Wood [5] conclude that their near shortest path routine solves the k-shortest path problem faster than other algorithms dedicated to solving the k-shortest path problem [25].

A label correcting algorithm with node-selection is identified as the most successful approach to solve BSP problems by Skriver and Andersen [27] and label setting as in Guerriero and Musmanno [9]. Raith and Ehrgott [25] conclude that two phase method is competitive with other commonly applied approaches to solve the BSP problem. The two phase method works well with both a ranking, a label correcting, and a label setting approach in phase 2, but the label correcting and setting approaches appear to be preferable as they are more stable. The purely enumerative near shortest path approach is a very successful approach to solve some problem instances, but the run-time on others is very long.

Skriver and Andersen [27] argued that the parametric approach is slower, due to the structure of the algorithm. The approach is to use the weighting method to find the efficient extreme paths, and then use backtracking of spanning trees to search for non-extreme efficient paths. The weighting method means solving LP problems, but for the shortest-path problem that is done by Dijkstra's shortest-path algorithm (or a similar algorithm). It turns out that Dijkstra's algorithm is actually a slower approach in practice than the Label correcting routine. On top of this comes the fact, that the weighting method of the parametric approach by far is faster than the backtracking part. When we are backtracking, we might have to evaluate all the edges in all the spanning trees in the worst case, resulting in an exponentially growing number of comparisons.

We are going to use in this paper phase I in the two phase method. The backtracking part which makes the two phase method slower than the labeling algorithms will not be used here. Since the non-extreme efficient paths need not be generated.

Skriver and Andersen [27] presented a label correcting algorithm for solving the BSP. They imposed some simple domination conditions, which reduced the number of iterations needed to find all the efficient (Pareto optimal) paths in the network. Guerriero and Musmanno [9] developed a solution of the multicriteria shortest path problem. They present

a class of labeling methods to generate the entire set of Pareto-optimal path-length vectors from an origin node s to all other nodes in a multicriteria network.

Raith and Ehrgott [25] compared different strategies for solving the BSP problem. They considered a standard label correcting and label setting method, a purely enumerative near shortest path approach, and the two phase method, investigating different approaches to solving problems arising in phases 1 and 2. In particular, they investigated the two phase method with ranking in phase 2. In order to compare the different approaches, they investigated their performance on three different types of networks. They were able to show that the two phase method is competitive with other commonly applied approaches to solve the BSP problem. The two phase method works well with both a ranking, a label correcting, and a label setting approach in phase 2, but the label correcting and setting approaches appear to be preferable as they are more stable.

Raith and Ehrgott [24] presented an algorithm to compute a complete set of efficient solutions for the biobjective integer minimum cost flow problem. They used the two phase method, with a parametric network simplex algorithm in phase 1 to compute all non-dominated extreme points. In phase 2, the remaining non-dominated points (non-extreme supported and non-supported) are computed using a $k-$ best flow algorithm on single-objective weighted sum problems. Eusébio and Figueira [13] presented an algorithm for finding all the non-dominated solutions and corresponding efficient solutions for biobjective integer network flow problems. The algorithm solves a sequence of $\varepsilon-$ constraint problems and computes all the non-dominated solutions by decreasing order of one of the objective functions.

Mote et al. [16] developed an algorithm to solve the BSP. This algorithm first relaxes the integrality conditions and solves a simple bicriterion network problem. The bicriterion network problem is solved parametrically, exploiting properties associated with adjacent basis trees. Consider the following biobjective linear programming formulation which is to send 1 unit of flow from the source s to every other node along efficient paths.

$$\min F(x) = \begin{cases} f_1(x) = \sum_{(i,j)\in P} c_{ij}x_{ij} \\ f_2(x) = \sum_{(i,j)\in P} d_{ij}x_{ij} \end{cases} \quad (10)$$

s. t.

$$\sum_{\{j:\,(i,j)\in E\}} x_{ij} - \sum_{\{j:\,(j,i)\in E\}} x_{ji} = \begin{cases} n-1 & if\ \ i=s \\ -1 & if\ i=t \end{cases}$$

$$x_{ij} \geq 0\ and\ integer\ , \forall (i,j) \in E$$

4 The Algorithm

The shortest path problem has been studied extensively and many polynomial and strongly algorithms for solving it have been proposed [see, [2]]. We present here a brief review of the primal simplex algorithm for the shortest path problem. Like minimum cost flow problem, the shortest path problem has a spanning tree solution. Because node s is the only source node to every other node is demand node, the tree path from the source node to every other node is a directed path. This implies that the spanning tree must be a directed out tree rooted at node s. Any spanning tree for the shortest path problem contains a unique directed path from node s to every other node. The single-objective shortest path simplex (SPS) algorithms maintain a basic solution at each stage. Every basic feasible solution corresponds to a spanning tree T of the network $G(V,E)$. Every feasible basis tree T is a directed-out (spanning tree) rooted at node s, and it represents nondegenerate solution, $i.e., x_{ij} > 0$ for all $(i,j) \in T$ because $x_{ij} = |N_j|$, where N_j denoted the set of nodes in the subtree of T rooted at j.

A dual variable associated with each node of $G(V,E)$ is a function $\pi: V \to R$. For a given dual variable π, the reduced dual of an arc (i,j) is defined as $\tilde{c}_{ij} = c_{ij} - \pi_i + \pi_j$. The SPS algorithm finds the optimal basis tree that is a tree of shortest paths and the optimal node potentials (dual variables) $\pi_i, i \in V$. These dual variables are defined by requiring that $\pi_s = 0$ and that $\tilde{c}_{ij} = 0$ for each arc in the spanning tree T.

At each iteration, the SPS algorithm selects an eligible arc to enter the basis. There are different rules for the selection of entering arcs. The process of moving from one feasible basis tree to another feasible basis tree is called a simplex pivot. On a simplex pivot an arc $(p,q) \notin T$ is added to T creating a unique cycle and an arc $(i,j) \in T$ is deleted yielding a new basis tree. A new basic feasible solution is obtained by replacing arc (p,q) by $(pred(q),q)$ in T and updating the node potentials $\pi_i, \forall i \in V$. In each step in the network simplex algorithm, a non-basic arc (p,q) with a negative reduced cost to introduce into the spanning

tree. The addition of arc (p, q) to the tree creates a cycle which we orient in the same direction as arc (p, q). Let w be the apex of this cycle. In this cycle, every arc from node q to node w is a backward arc and every arc from node w to node p is a forward arc: Consequently, the leaving arc would lie in the segment from q to
w . In fact, the leaving arc would be the arc $(pred(q), q)$ because this arc has the smallest flow value among all arcs in the segment from node q to node w.
According to the above discussion, if (p, q) is an entering arc on a simplex pivot and $p \notin N_q$, then the leaving arc is $(pred(q), q)$. If $p \in N_q$ then the network contains a negative cost cycle which yields unbounded solution. Let $NB = \{(i, j) \notin T: \tilde{c}_{ij} < 0\}$ be the set of all nonbasic arcs. The algorithm would then increase the potentials of nodes in the subtree rooted at node q by the amount $|\tilde{c}_{ij}|$ update the tree indices, and repeat the computations until all nontree arcs have nonnegative reduced costs. When the algorithm terminates, the final tree would be a shortest path tree ($i.e.$, a tree in which the directed path from node s to every other node is a shortest path).

4.1 Parametric Simplex

The optimal solution to the MCRRPP corresponds to an extreme supported non-dominated point of the BSP, so we present an algorithm that computes a complete set of extreme supported non-dominated points in the objective space. We will not compute the non-supported non-dominated points.
The two phase method [25] is based on computing supported and non-supported non-dominated points separately. In phase 1 extreme supported efficient solutions are computed, possibly taking advantage of their property of being obtainable as solutions to the weighted sum problem (4). The other approach is based on the network simplex method where extreme efficient solutions are generated in a right-to-left (or left-to-right) fashion. In phase 2 the remaining supported and non-supported efficient solutions can be computed with different enumerative approaches, as there is no theoretical characterization for their efficient calculation. It is expected that the search space for the enumerative approach in phase 2 is highly restricted due to information obtained in phase 1 so that the associated problems can be solved a lot quicker than by solving BSP with a purely enumerative approach only. The enumerative methods can be employed in a very effective way as enumeration can be restricted to small areas of the objective space. Phase 2 must determine $x \in X$ such that $F(x)$ is in the triangle defined by two consecutive non-dominated supported points in the objective space (see Fig. 1).
In this paper, according to Theorem 2, we need only to consider phase 1 to compute a complete set of extreme supported efficient solutions. We use a parametric simplex method proposed by Sedeño-Noda and González-Martín [14]. Initially, one of the two lexicographically optimal solutions, e.g., the $lex(1, 2)$-best solution, is obtained with a single-objective network simplex algorithm with $lex(1, 2)$ objective. The procedure generates a complete set of extreme efficient solutions moving in a right-to-left fashion. In the single-objective network simplex [2], each BFS is represented by a tree given by a set of basic arcs with flow $x_{ij} > 0$, since the variables in the minimum cost flow formulation of the shortest path problem have no upper bounds; all nontree (non-basic) arcs are at their lower bounds and have a flow of $x_{ij} = 0$. Let $L^t = \{(i, j) \in E: (i, j)\ is\ non - basic\ in\ BFS\ xt\ with\ xt{=}0.$
The efficient frontier is built in a right-to-left fashion, using network simplex algorithm for the single criterion optimization. Starting with lexicographical minimum for the second objective, the arc entering the basis is chosen upon a determination of the smallest ratio between reduced costs for the two criteria. The reduced costs of a given arc (i, j) are defined as follows:

$$\tilde{c}_{ij} = c_{ij} - \pi_i^c + \pi_j^c$$
$$\tilde{d}_{ij} = d_{ij} - \pi_i^d + \pi_j^d$$

In each iteration from the list St of arcs yielding the minimal ratio of the reduced costs one arc is chosen to enter the basic tree of the current efficient basic feasible flow x.
The algorithm starts with the extreme supported non-dominated point $y^{(0)} = (\tilde{y}_1, y_2^*)$ associated with the lexicographically minimum of $f_2(x)$, $(y_2^* = \min x{\in}Xf2x,\ y1{=}\min x{\in}X{*}f1x$, where $X{*}{=}x{*}$: $f2x{*}{=}y2{*}$ and ending with the minimum of $f1x$.

Our algorithm is based on the algorithms presented by Sedeño-Noda and González-Martín [14, 15] which is modified by Raith and Ehrgott [24]. These algorithms for solving the continuous biobjective minimum cost flow problem and the biobjective integer minimum cost flow problem.

Algorithm

1. Compute $y_1^{(0)} = (y_1^*, \tilde{y}_2) = lex\min_{x\in X}\begin{pmatrix} f_1(x) \\ f_2(x) \end{pmatrix}$, and $y^{(0)} = (\tilde{y}_1, y_2^*) = lex\ \min_{x\in X}\begin{pmatrix} f_2(x) \\ f_1(x) \end{pmatrix}$
2. Let $x^{(0)}$ be the starting extreme supported efficient solution corresponding to $y_2^{(0)}$, $EX\_EFF = \{x^{(0)}\}$, and let C_{min} be the length of the shortest path from s to t corresponding to the spanning tree generated by solving $y_1^* = \min_{x\in X} f_1(x)$
3. Compute the reduced costs $\tilde{c}, \tilde{d}$ for $x^{(0)}$
4. Set $z^* = M$ (a large number)
5. Set $t = 1,\ k = 1$
6. Compute_Entering_Arcs$(L^{t-1}, c, \pi^c, \pi^d, S^{t-1}, w^{t-1})$
7. **While** $S^{t-1} \neq \emptyset$ **do**
8. **Begin**
9. $x^t = Compute\_New\_BFS(x^{t-1}, L^{t-1}, \pi^c, \pi^d, S^{t-1})$
10. Update $\tilde{c}, \tilde{d}$ and x^t
11. Compute_Entering_Arcs$(L^{t-1}, c, \pi^c, \pi^d, S^{t-1}, w^{t-1})$
12. **If** $w^t \neq w^k$ **then**
13. $w^k = w^t$ and $x^k = x^t$
14. $EX\_EFF = EX\_EFF \cup \{x^k\}$
15. Identify the unique directed path P_k in the feasible spanning tree of shortest paths T_k from s to t
16. Compute $z(P_k) = \frac{C(P_k)}{R(P_k)}$
17. **If** $z(P_k) \leq z^*$, **then** set $z^* = z(P_k)$ and $P^* = P_k$
18. **If** $h_k(C_{min}) \geq z^*$, **then** P^* is an optimum path with z^* as the objective function value. Go to 25.
19. **end if**
20. **end if**
21. $k = k + 1$
22. **end if**
23. $t = t + 1$
24. **end while**
25. $z(P^*) = \frac{C(P^*)}{R(P^*)}$ is the optimal solution

Procedure 1 Compute_Entering_Arcs $(L^t,\ \tilde{c},\ \tilde{d},\ \pi^c,\ \pi^d,\ S^t,\ w^t)$

1. **Begin**
2. $\tilde{c}_{ij} = c_{ij} - \pi_i^c + \pi_j^c$
3. $\tilde{d}_{ij} = d_{ij} - \pi_i^d + \pi_j^d$
4. $S^t = \emptyset$
5. Set $w^t = \left\{\frac{\tilde{d}_{ij}}{\tilde{c}_{ij}}: \tilde{d}_{ij} < 0\ and\ \tilde{c}_{ij} > 0,\ \forall (i,j) \in L^t\right\}$
6. Let $S^t \subseteq L^t$ be the set of non-basics arcs for which $\min w^t$ is attained
7. **end**

Procedure 2 Compute_New_BFS $(x^t,\ L^t,\ \pi^c,\ \pi^d,\ Pred,\ Depth,\ Thread,\ S^t)$

1. **While** $S^t \neq \emptyset$ **do**
2. Let (i,j) be the first arc in S^t; set $S^t := S^t - (i,j)$
3. **If** $\tilde{d}_{ij} < 0,\ \tilde{c}_{ij} > 0$ and $(i,j) \in L^t$ **then**
4. Perform simplex-pivot with entering arc (i,j)
5. Update $x^t,\ L^t,\ \pi^c,\ \pi^d,\ Pred,\ Depth,\ Thread,\ S^t$
6. **end if**
7. **end while**

The Compute_Entering_Arcs procedure calculates the set of arcs S^t those arcs that do not fulfill the optimality conditions with respect to the second objective: These make up the sequence of pivots to reach the adjacent extreme ND point in the objective space. One of the candidate arcs $(i,j) \in S^t$ is removed from S^t and enters the basis. By performing a simplex-pivot with entering arc (i,j) , $i.e.$, introducing the arc (i,j) into the basis and removing the leaving arc $(pred(j),j)$ from the basis, the reduced costs may change. The reduced costs of all arcs remaining in S^t are updated according to the BFS obtained by pivoting (i,j) into x^t. As long as there are arcs remaining in S^t with $\tilde{d}_{ij} < 0 \; and \; \tilde{c}_{ij} > 0, \forall (i,j) \in L^t$.

The Compute_new_BFS procedure carries out these pivots updating the spanning tree structure. The next BFS x^{t+1} might de.ne an extreme ND point $\left(f_1(x^{t+1}), f_2(x^{t+1})\right) \in conv(Y)$. Denote by x^k the last extreme efficient solution that was found so far. If for the new minimal ratio w^{t+1} we have $w^{t+1} \neq w^t$, then x^{t+1} corresponds to an extreme efficient solution. On the other hand, if $w^{t+1} = w^t$ then x^{t+1} is not extreme, $i.e.,\left(f_1(x^{t+1}), f_2(x^{t+1})\right)$ corresponds to a supported non-extreme ND point.

It may be pointed out that every iteration in the above algorithm does not yield a new efficient path. The pivot operations may change the tree of shortest paths, but may not change the path from s to t. It can be easily seen that P_k from s to t changes if and only if the entering arc is incident on a node belonging to P_k. Also, to obtain the first efficient path, the algorithm selects arcs with $\tilde{d}_{ij} = 0$ if they exist, and performs the pivot operation.

In case of all edge failure rates are equal, the extreme supported ND points in the objective space on $G(V,E)$ are determined as follows

Step 1: Generate $\tilde{G}(V,E)$ by finding "artificial" distances $d_{ij}^A = \lambda d_{ij}$ for each edge $(i,j) \in E$.
Step 2: Find the set of extreme supported non-dominated points in the objective space on $\tilde{G}(V,E)$.
Step 3: Calculate the set of extreme supported non-dominated points in the objective space on $G(V,E)$ as follows $\left(C(P) = \sum_{(i,j)\in P} c_{ij}\,, D(P) = \sum_{(i,j)\in E} \frac{d_{ij}}{\lambda}\right)$.

Theorem 7 In the worst case, the algorithm generates the complete set of extreme efficient solutions of BSP.
Proof See Theorem 1 in [24]■

5 Numerical Example

The following example problem is provided to demonstrate the procedure presented in the previous section. The example problem network consists of 10 nodes and 21 directed arcs, Nodes 1 and 10, natively, are the origin and destination nodes. The arc costs c_{ij}, distances d_{ij}, artificial distances $\lambda_{ij} d_{ij}$ and reliability p_{ij} are given in Table 3.

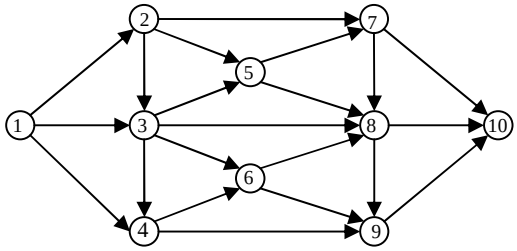

Figure 2: Example network consisting of 10 nodes and 21 directed edges

The example has seven efficient extreme supported points in the decision space, the images of these points corresponds to extreme supported non-dominated points in the objective space.

The algorithm begins by generating the lexicographical solutions $y_1^{(0)}$ and $y_2^{(0)}$ for BSP problem. This can be done by making use of the network simplex algorithm, solving the network parametric problem $\min_{x\in X} \lambda f_1(x) + (1-\lambda) f_2(x)$ with $\lambda = 1$ and $\lambda = 0$, respectively. The Compute_Entering_Arcs procedure computes the arcs that do not fulfill the optimality conditions with respect to the second objective. These arcs make a sequence of pivots to reach an adjacent supported extreme non-dominated point in the objective space. The Compute_New_BFS procedure updates the spanning tree structure, the tree indices and the potentials of the nodes with respect to the two objectives.

If $h_{k+1}(C_{min}) \geq z^*$, then P^* is an optimum path with z^* as the objective function value and the algorithm terminates. When $C(P), D(P) = (205, 230)$, $z(P) = \frac{C(P)}{e^{-D(P)}} = \frac{205}{e^{-230}} = 1.583 \times 10^{102}$. When the algorithm reaches the adjacent point $(70, 245)$, the objective value is $z(P) = \frac{170}{e^{-245}} = 4.2914 \times 10^{108}$.

Table 4 presents the spanning trees representing the seven supported extreme efficient points in the decision space. It also gives the objective values of $\left(f_1(x), f_2(x)\right)$ and the corresponding shortest path lengths from the source to destination $\left(C(P), D(P)\right)$. Figure 3 presents the set of all extreme supported ND points in the objective space.

Table 3: Arcs costs, distances and artificial distances for the network example

(i,j)	c_{ij}	d_{ij}	$p_{ij}=e^{-d_{ij}}$	λ	$p_{ij}=e^{-\lambda d_{ij}}$	λ_{ij}	$\lambda_{ij}d_{ij}$	$p_{ij}=e^{-\lambda_{ij}d_{ij}}$
(1,2)	**10**	**60**	8.7565×10^{-27}	0.006	0.69768	0.011921	0.71526	0.48906
(1,3)	**25**	**80**	1.8049×10^{-35}	0.006	0.61878	0.006412	0.51296	0.59872
(1,4)	**20**	**75**	2.6786×10^{-33}	0.006	0.63763	0.008084	0.6063	0.54536
(2,3)	**5**	**45**	2.8625×10^{-20}	0.006	0.76338	0.021228	0.95526	0.38471
(2,5)	**75**	**30**	9.3576×10^{-14}	0.006	0.83527	0.037815	1.1345	0.32160
(2,7)	**95**	**15**	3.059×10^{-7}	0.006	0.91393	0.085012	1.2752	0.27938
(3,4)	**65**	**10**	4.5400×10^{-5}	0.006	0.94176	0.138859	1. 3886	0.24943
(3,5)	**90**	**20**	2.0612×10^{-9}	0.006	0.88692	0.059195	1. 1839	0.30608
(3,6)	**75**	**15**	3.059×10^{-7}	0.006	0.91393	0.084184	1. 2628	0.28287
(3,8)	**60**	**85**	1.2161×10^{-37}	0.006	0.60050	0.005211	0.44294	0.64215
(4,6)	**40**	**120**	7.6676×10^{-53}	0.006	0.48675	0.001885	0.2262	0.79756
(4,9)	**35**	**110**	1.6889×10^{-48}	0.006	0.51685	0.002582	0.28402	0.75275
(5,7)	**25**	**160**	3.2575×10^{-70}	0.006	0.38289	0.000684	0.10944	0.89634
(5,8)	**145**	**50**	1.9287×10^{-22}	0.006	0.74082	0.018245	0.91225	0.40162
(6,8)	**130**	**80**	1.8049×10^{-35}	0.006	0.61878	0.006201	0.49608	0.60891
(6,9)	**55**	**140**	1.5804×10^{-61}	0.006	0.43171	0.000925	0.1295	0.87853
(7,8)	**140**	**35**	6.3051×10^{-16}	0.006	0.81058	0.028206	0.98721	0.37261
(7,10)	**65**	**170**	1.4789×10^{-74}	0.006	0.36059	0.000562	0.09554	0.90888
(8,9)	**10**	**60**	8.7565×10^{-27}	0.006	0.69768	0.011962	0.71772	0.48786
(8,10)	**70**	**185**	4.5240×10^{-81}	0.006	0.32956	0.000452	0.08362	0.91978
(9,10)	**150**	**45**	2.8625×10^{-20}	0.006	0.76338	0.021224	0.95508	0.38478

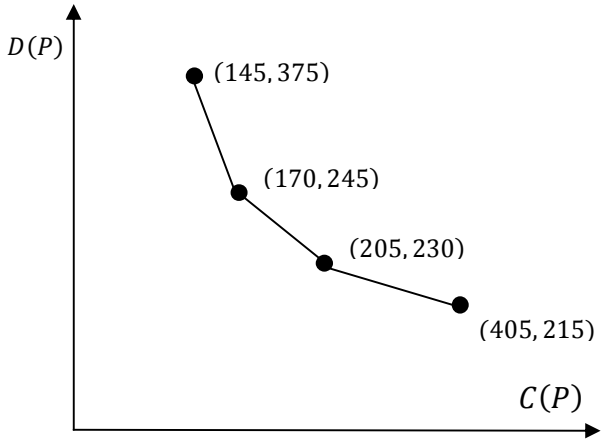

Figure 3: The set of extreme supported non-dominated points of min(C(P), D(P))

In case of considering the operational probability of each edge as $p_{ij}=e^{-\lambda_{ij}d_{ij}}$, two cases are considered:

Case 1: All failure rates are equal. Let $\lambda_{ij}=\lambda$. Then $\breve{G}(V,E)$ is a scaled version of $G(V,E)$, $i.e.$, the two networks share V and E and each edge in $\breve{G}(V,E)$ is λ times the original distance associated with each edge in $G(V,E)$, $d_{ij}^{A}=\lambda d_{ij}$. In this case, we get the same optimal solution as the case $p_{ij}=e^{-d_{ij}}$.

Case 2: Failure rates are not equal. In this case, we may get different optimal paths, $i.e.$, different extreme supported ND points for the BSP from that of operational probabilities $p_{ij}=e^{-d_{ij}}$. Table 3 gives the data for this case.

Table 4: The optimal shortest path spanning trees corresponding to the efficient extreme solutions in the decision space

	x^1	x^2	x^3	x^4	x^5	x^6	x^7
$(1,2)$	√	√	√	√	√	√	√
$(1,3)$	√	√	√	√	√		
$(1,4)$	√	√	√	√	√	√	√
$(2,3)$						√	√
$(2,5)$	√	√	√	√	√	√	√
$(2,7)$	√	√	√	√	√	√	√
$(3,4)$							
$(3,5)$							
$(3,6)$	√	√	√	√			
$(3,8)$			√	√	√	√	√
$(4,6)$					√	√	√
$(4,9)$		√	√	√	√	√	√
$(5,7)$							
$(5,8)$							
$(6,8)$							
$(6,9)$							
$(7,8)$	√	√					
$(7,10)$				√	√	√	
$(8,9)$	√						
$(8,10)$							√
$(9,10)$	√	√	√				
$f_1(x)$	1250	850	690	655	615	595	570
$f_2(x)$	970	1000	1055	1070	1170	1220	1350
$C(P)$	405	205	205	170	170	170	145
$D(P)$	215	230	230	245	245	245	375

6 Conclusions

In this paper, we considered the minimum cost-reliability ratio path Problem. The optimal solution of the MCRRPP corresponds to a supported extreme non-dominated point in the objective space of a biobjective shortest path. We used only phase 1 in the two phase method for BSP to generate the set of supported extreme non-dominated points in the objective space. We used the termination criterion presented by Ahuja [1] when the optimum solution is reached. In the worst case, starting with the supported extreme non-dominated point $(\tilde{y}_1, y_2^*) = lex\ \min_{x\in X}\begin{pmatrix} f_2(x) \\ f_1(x) \end{pmatrix}$, we will reach the point $(y_1^*, \tilde{y}_2) = lex\ \min_{x\in X}\begin{pmatrix} f_1(x) \\ f_2(x) \end{pmatrix}$. In each simplex iteration, the basic entering arc is chosen to be an arc with the least ratio between improvement of $f_2(x)$ and the deterioration of $f_1(x)$, both expressed through reduced costs. Whenever, the shortest path from s to t changes, another non-dominated point is found.

In case of using the logarithmic transformation between operational probability and edge length, which was proposed by Melachrinoudis and Helander [19], to calculate for each edge the "artificial" edge length $d_{ij}^A = \lambda_{ij} d_{ij}$ and to define a new network $\check{G}(V,E)$ with the same sets of edge attributes costs, c_{ij} and operational probabilities, $p_{ij} = e^{-d_{ij}^A}$, but its edge distances are $d_{ij}^A, (i,j) \in E$. The optimal solution of (8) corresponds to a supported extreme non-dominated point of (9).

An area of future research is the generation of test instances and tests the proposed algorithm. Also, a comparison of different solution strategies for the BSP and investigate their performance on different types of networks with the algorithm presented in this paper should be developed in the future.

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7/30/2012

A Novel Nanometric Reversible Four-bit Signed-magnitude Adder/Subtractor

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Abstract: The reversible logic plays a significant role in the synthesis of circuits for quantum computing. Reversible gates have been widely used in low power CMOS design, optical information processing, and bioinformatics, quantum computing and nanotechnology-based systems. A new 3×3 reversible two's complement gate is suggested in this paper. Two quantum models are offered for two's complement gate. These quantum models differ from each other with respect to the quantum cost. Two novel reversible four-bit signed-magnitude adders/subtractors with HNG and ADD/SUB gates are also proposed for the first time. The proposed circuits detect overflow and produce a correct result for inputs in the range of [-7, 7]. The proposed two's complement gate is used in part of the reversible four-bit signed-magnitude adder/subtractor design. The proposed reversible 4-bit signed-magnitude adders/subtractors are evaluated in terms of number of reversible gates, number of garbage outputs, number of constant inputs, quantum cost and hardware complexity. All the scales are in the nanometric area.
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Key words: nanotechnology based systems; quantum computing; reversible logic; reversible signed-magnitude adder/subtractor.

1. Introduction

One of the most prominent incentives for the study of reversible computing comes from the desire to reduce heat dissipation in computing machinery, and thus achieve higher density and speed (Toffoli, 1980). Reversible computing, in a general sense, means computing using reversible operations, that is, operations that can be easily and exactly reversed, or undone. Reversible operations realize bijective Boolean functions. Conventional gates such as AND, XOR, OR, etc., that are used in digital design are not reversible. Landauer (1961) proved that classical non-reversible circuits inevitably produce heat because of losses of information during the computation. Landauer's principle (Landauer, 1961) states that generated heat for each bit of information lost is KTln2 joules of energy, Where K= $1.3806505*10^{-23}m^2$ kg^{-2} K^{-1} (joule/Kelvin) is Boltzmann constant and T is the temperature in Kelvin degrees at which operation is performed. Bennett's (Bennett, 1973) theory was developed to compensate energy dissipation. Bennett's theorem suggests that every future binary technology will have to use some kind of reversible gates in order to reduce heat dissipation (Mozammel, 2008). Bennett (Bennett, 1973) showed that zero energy dissipation is possible in Reversible logic computing, that is a reversible logic gate has a one-to-one mapping between the inputs and outputs. Some restrictions of reversible circuits include Fan-out and loop or feedback. Recently, researchers illustrated that feedback is allowed in reversible computing in a case of sequential circuit's design (Thapliyal and Ranganathan, 2010). Quantum technology is inherently reversible and it will become very important for future computing systems (Mozammel, 2008). In reversible logic the output logical states uniquely define the input logical states of the computational operation. Reversible logic circuits encompass the same number of input and output lines. Such circuits (gates) can produce inputs from the corresponding outputs and vice versa. On the other hand, the digital computer is a digital system that performs various computational tasks by arithmetic circuits such as Adders, Subtractors, Multipliers and Dividers from which Adders and Subtractors are the most essential blocks of a computing system. So some reversible Adders and Subtractors for unsigned numbers have been proposed in (6-14) and only one paper (Emam and Elsayed, 2010) has been proposed so far on reversible Adder/Subtractor for signed/unsigned binary numbers. The author in (Emam and Elsayed, 2010) proposed a circuit for addition and subtraction signed numbers represented in two's complement representation and no circuit for addition and subtraction signed numbers represented in the signed-magnitude representation so far, has been designed. For floating-point operations, most computers use the signed-magnitude representation for the mantissa, so addition and Subtraction floating-point numbers needed signed-magnitude Adder/Subtractor. Thus, in this article a circuit is proposed for Addition and Subtraction signed numbers represented in the signed-magnitude representation.

The paper is structured around the following sections: section 2 discusses the proposed reversible gate and some necessary reversible logic gates. Section 3 provides essential background on irreversible signed-magnitude full adder/subtractor. The proposed four-bit reversible signed-magnitude adders/subtractors with HNG and ADD/SUB gates and different parts of the proposed reversible signed-magnitude Adder/Subtractor are described in section 3 too. The simulation results with VHDL language and Quartus simulator is shown in section 4 and conclusions are contained in section 5.

2. Reversible Gates

The quantum cost(QC) of any reversible gate(circuit) is the number of 1×1 or 2×2 reversible gates and quantum logic gates such as V, V^+ (V is also named square root of NOT gate $\sqrt{NOT}$ and V^+ is hermitian of V). The V and V^+ quantum gates have some properties that are shown in Equation (1) (Mohammadi et al., 2009).

$$(1) \quad \left\{ \begin{array}{c} V \times V = NOT \\ V \times V^+ = V^+ \times V = I \\ V^+ \times V^+ = NOT \end{array} \right\}$$

Any reversible logic gate (circuit) is realized by using mentioned gates above, NOT and FG gates. This section proposes a new reversible logic gate which is termed two's complement gate as shown in Figure 1, and its truth table is presented in Table 1. Then this section introduces NLG and ADD/SUB gates. For aware of other utilized reversible gates such as NOT, FG, F2G, FRG, HNFG, HNG, PG you can refer to (13-19) references.

Two's complement Gate

A new 3×3 reversible logic gate is 2's complement gate. This gate is very important in circuits design because Complements are used in digital computers for logical operation and simplifying the subtraction function. The proposed reversible 2's complement gate is depicted in Figure 1. The 2's complement gate can be represented as:

$I_v = (A, B, C)$

$O_v = (P = A, Q = A \oplus B, R = A \oplus B \oplus C \oplus AB)$

Where, I_V and O_V are the input and output vectors.

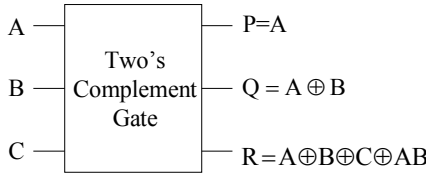

Figure 1. The proposed Two's Complement Gate

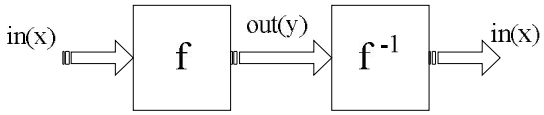

Figure 2. Characteristics of a self-inverse gate

Reversible 2's complement gate is a one through gate, and its truth table is shown in table 1. According to this table for every input pattern there is a unique output pattern. Reversible 2's complement gate is also a self-inverse gate. A function is self-inverse, If an input x into the function f produces an output y, then putting y into the inverse function f^{-1} produces the output x, and vice versa. Figure 2 shows the characteristics of a self-inverse gate.

Table 1. Truth table of 2's complement gate

C	B	A	R	Q	P
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	0	0
1	0	1	0	1	1
1	1	0	0	1	0
1	1	1	0	0	1

Two quantum models are proposed for this gate which is demonstrated in Figure 3. The quantum cost of reversible 2's complement gate is 6 in Figure 3a. The QC is 5, in Figure 3b. The optimized QC is 5 for this gate.

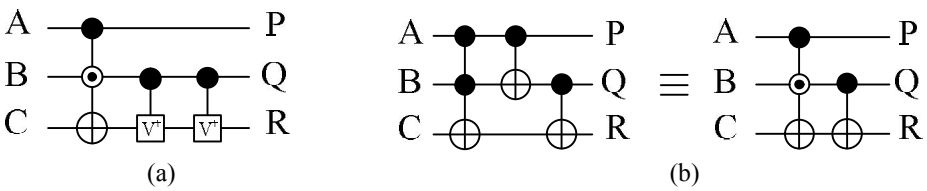

Figure 3. Two quantum models for Two's Complement Gate

NLG Gate

NLG gate is abbreviation for new reversible logic gate that has been proposed in (Lihui et al., 2010) for the first time. NLG gate is a one through gate as shown in figure 4. Quantum model and Quantum cost of this gate has not been reported in (Lihui et al., 2010). So this article proposes two quantum models for this gate which are demonstrated in figure 5. Figure 5a uses quantum gates V and V^+ and Figure 5b uses FG and NOT gate. The quantum cost is four in Figure 5a and it is one in Figure 5b which is the lowest quantum cost.

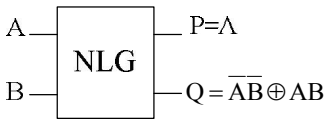

Figure 4. NLG gate

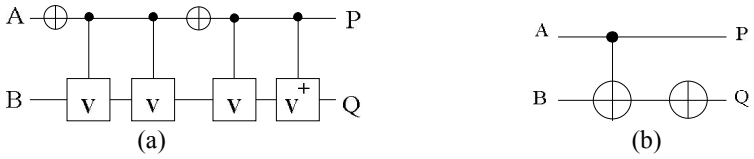

Figure 5. Proposed equivalent quantum representation of NLG gate

ADD/SUB Gate

ADD/SUB gate is a reversible 4×4 gate. It has been proposed in (Emam and Elsayed, 2010) for the first time. This gate can be represented as:

$I_v = (F, A, B, C)$

$O_v = (P = A \oplus B \oplus C, Q = C / B, R = A, S = F \oplus B)$

Where I_V and O_V are the input and output vectors. If F input is set to zero then the ADD/SUB gate will work as a reversible full adder or else the gate will work as a reversible full subtractor as shown in figures 6b and 6c respectively.

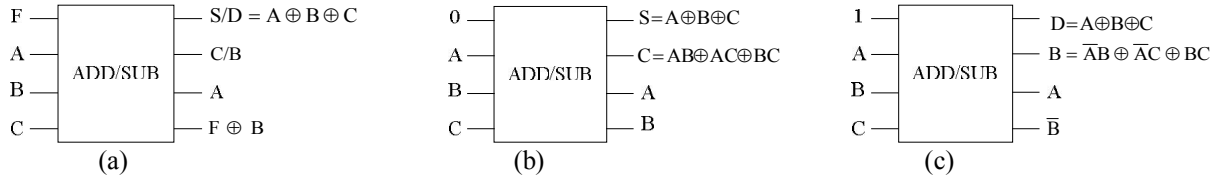

Figure 6. Reversible ADD/SUB gate (a) symbol, (b) Full Adder, (c) Full Subtractor

3. Basic Concepts

There are two different common forms of representation for negative fixed-point numbers in a radix r system.

1. Sign and magnitude representation, which is also called the signed-magnitude method.
2. Complement representation which comprises two alternatives:

(I) Two's complement in the binary system

(II) One's complement in the binary system

When an integer binary number is positive, the sign is represented by 0 and the magnitude by a positive binary number. When the number is negative, the sign is represented by 1 but the rest of the number may be represented in one of the three aforementioned ways (signed-magnitude, one's complement and two's complement representation). Reversible Signed numbers Adder/Subtractor circuit design based on these methods will be different. In this article the main opinion is designing reversible signed-magnitude adder/subtractor. The algorithm for signed-magnitude adder/subtractor is more complex than addition and subtraction numbers in signed-complement system, because not only it needs circuits to add and subtract but also its implementation needs circuits to compare the signs and the magnitudes of the numbers. The range of n bit integer numbers in the signed-magnitude system is symmetric and equals

$-(2^{n-1}-1) \le X \le (2^{n-1}-1)$

So the range of 4 bits integer numbers in the signed-magnitude system is [-7, 7]. The leftmost bit of the signed-magnitude number shows the number sign. As a result, there are two representations of

zero, a positive zero represented by 000...0, and a negative zero represented by 100...0, but in addition and subtraction for signed-magnitude numbers only positive zero is produced, so this is one advantages of the proposed design. The signed-magnitude adder/subtractor flowchart is presented in figure 7. A, B determine the magnitude of the two numbers and A_s, B_s show the signs of A and B respectively. According to the flowchart, A_s and B_s determine addition or subtraction operation. If $A_S \oplus B_S = 0$ then the signs will be identical otherwise the signs will be different. Depending on the selected operation, adding or subtracting, the micro operations $ES \leftarrow A + B$ or $ES \leftarrow A - B$ is done (subtraction with two's complement method). E indicates the output carry when A and B are added. An overflow may occur if the two numbers added are both positive and both negative. So if the carry in E is equal to one then the overflow will occur. Since the addition and subtraction of the four bit signed-magnitude numbers are covered in the range of [-7, 7], the final result is considered 5 bits (because of the overflow). According to the existence flowchart in figure 7, If the micro operation $ES \leftarrow A + \overline{B} + 1$ is done and E is equal to one (E=1) then A will be larger than or equal to B (A≥B). In this case if S=0 then A will equal to B and the sign S_s must be positive to avoid a negative zero, otherwise A will be larger than B (A>B) and the number in S is the correct result. If E is equal to zero (E=0) then A will be less than B (A<B), thus the sign S_s is equivalent to complement the sign of A and the correct result is the two's complement of the value in S (Koren, 1945; Mano, 2001).

3.1 Proposed Design

Figure 8 shows the traditional block diagram of the proposed design. This block Adds/Subtracts two signed-magnitude four bit numbers. It has nine inputs consisting of A and B inputs that each are three bits and two signed bits A_S and B_S, and $C_{F/S}$ signal is also used as the control input. If $C_{F/S} = 0$, the operands are added otherwise they are subtracted. This block diagram has also four outputs consisting of S_S which is considered as a signed bit for output bits and E, S_0, S_1 and S_2 outputs. Since the addition and subtraction of the four bit signed-magnitude numbers are covered in the range of [-7, 7], the final result is considered 5 bits. This article based on this block diagram and aforesaid flowchart in previous section proposes a Four-bit Reversible Signed-magnitude Full Adder/Subtractor. Therefore in next sections, necessary parts are introduced for designing this circuit.

3.2 The proposed Circuit for Input Ctrl Signal of Reversible Ripple Adder/Subtractor with HNG gate

Two numbers are added If the signs are identical for an add operation or different for a subtract operation. If the signs are dissimilar for an add operation or similar for a subtract operation then two numbers will be subtracted. The existing circuit in figure 9 implements aforementioned characteristics and the output is the control input of the reversible ripple adder/subtractor. This proposed circuit and quantum representation are depicted in figure 9a and 9b respectively.

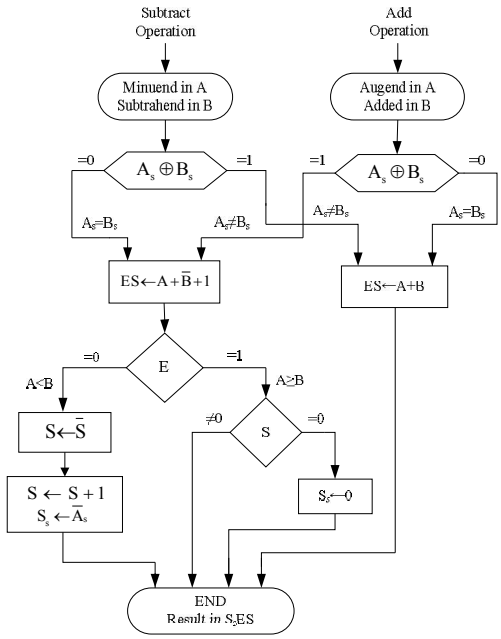

Figure 7. Flowchart for signed-magnitude adder/subtractor

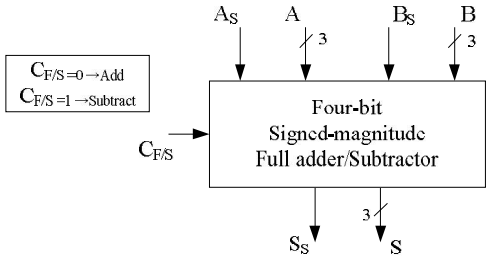

Figure 8. Block Diagram of The Irreversible Four-bit Signed-magnitude Full Adder/Subtractor

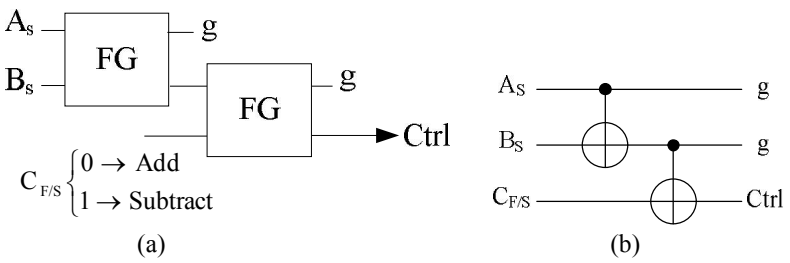

Figure 9. Two symbols of Proposed Circuit For Control Input

The existence circuit in figure 9 has three outputs consist of two garbage outputs and Ctrl output that is connected to control input of the reversible ripple adder/subtractor. If Ctrl= 0, the operands are added otherwise they are subtracted (two's complement method). Reversible Four-bit Signed-magnitude Adder/Subtractor design requires a three-bit reversible two's complement adder/subtractor. The reversible two's complement adder/subtractor with proposed circuit for Ctrl signal and its quantum implementation are shown in figure 10 and 11 respectively.

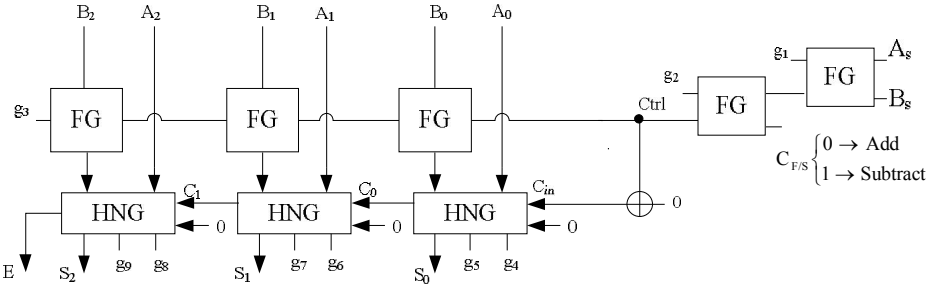

Figure 10. The reversible adder/subtractor with proposed Ctrl signal

As can be seen in figure 10 if Ctrl=0, then the micro operation $S = A + B$ will be performed otherwise the micro operation $S = A + \overline{B} + 1$ will be performed. The existing design in figure 10 has 9 garbage outputs and 4 constant inputs with QC=24. The existing design in figure 11 requires 6 garbage outputs and 3 constant inputs with QC=23.

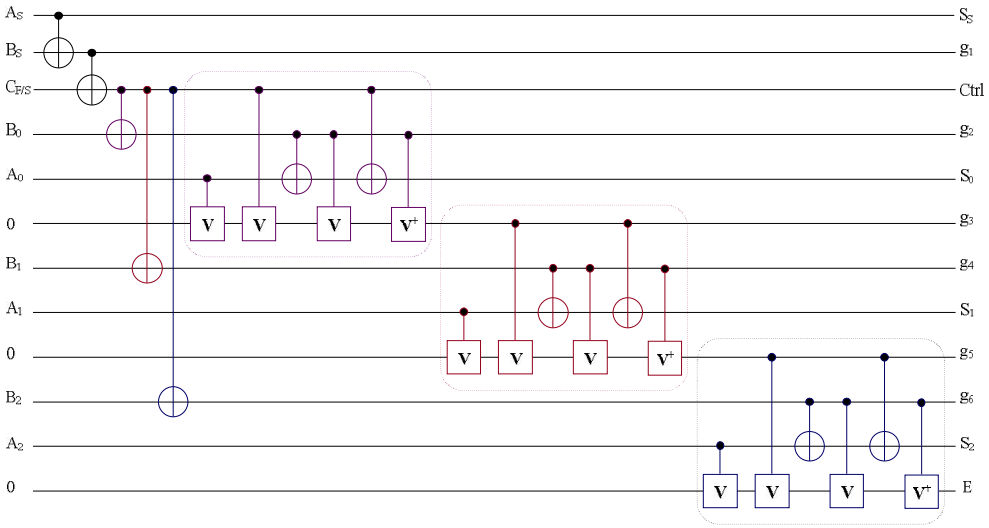

Figure 11. Quantum implementation of reversible adder/subtractor with proposed Ctrl signal

3.3 Proposed Circuit for A=B State

If Ctrl signal is set to one then micro operation $ES \leftarrow A + \overline{B} + 1$ will be done. In this case if E is equal to one and the number in S is equal to zero then A will be equal to B. Therefore in this section a reversible circuit is proposed to compare the existing number in S with zero. Thus, when A is equal to B, the number in S is the correct result, but the sign S_s must be positive to avoid a negative zero. For implementation circuit that compares the result with zero, we can use the following equation:

(2) $(S_2 \odot 0)(S_1 \odot 0)(S_0 \odot 0) = 1$

The proposed circuit Based on the equation (2) is demonstrated in figure 12. This proposed circuit have been designed using NLG and PG gates with QC=11. It needs 5 constant inputs, 7 garbage outputs and 5 gates. DC inputs and outputs are an important figure of merit to evaluate a design. In this research, the quantum model is proposed to optimize garbage inputs and outputs. As it is shown in figure 12b, the quantum circuit has 2 DC inputs, and 4 DC outputs and 5 gates. The quantum cost of the circuit is also 11.

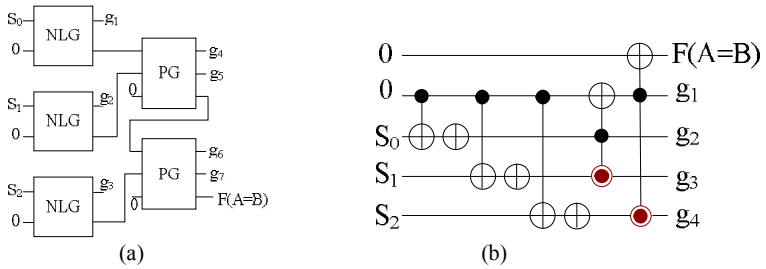

Figure 12. The reversible circuit for comparing the 3 bit number with zero

3.4 investigating Circuit In A>B State

If Ctrl signal is set to one then micro operation $ES \leftarrow A + \overline{B} + 1$ will be done. In this case if E is equal to one and the number in S is opposite of zero then A will be larger than B. Therefore the number in S is the correct result and the sign of the result is the same as the sign of A, so no change in A_S is required. Thus it is required to use multiplexer 2×1 in order to select the sign of S_S between two states A=B and A>B. Fredkin gate is applied as a multiplexer in figure 13. Note that this reversible multiplexer has 3 inputs (0, A_S and control) and one main output and 2 garbage outputs. F (A=B) signal in figure 12 is used as the control input for multiplexer. The reversible multiplexer applies 0 for A=B(S=0) state or A_S for A>B (S≠0) state.

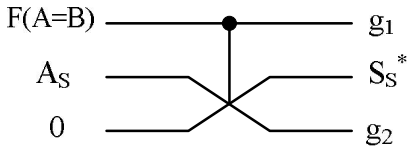

Figure 13. FRG as a MUX 2×1 for implementation sign bit

3.5 investigating Circuit In A<B State

If the $ES \leftarrow A + \overline{B} + 1$ operation is performed and E is equal to zero then A will be less than B. In this case the two's complement of the value in S must be obtained to create the correct result. In the proposed circuit this operation is done by using Two's complement gate. In this case the sign of result is the complement of the original sign of A, so A_S is complemented by using NOT gate for obtaining the correct sign.

3.6 Proposed Four-bit Reversible Signed-magnitude Adder/Subtractor with HNG gate

Four-bit reversible signed-magnitude adder/subtrator is proposed in figure 14. The circuit function is described, according to the existing flowchart in Figure 7 and table 2.

Table 2. Determining operations and carry out in Adder/Subtractor

ctrl	E
0	0
0	1
1	0
1	1

The proposed design utilizes two FRG gates (F1&F2) as a multiplexer 4×1 to determine the sign S and also four FRG gates (F3, F4, F5 & F6) to distinguish the final result (ES). In the first and second rows of Table 2, the Ctrl signal is zero and A_S passes to the second output of FRG (F2) gate (S_S), and when the Ctrl signal is set to one in the next rows, depending on the value of E, signal $\overline{A}_S$ or S_S^* passes to the second output of FRG (F2) gate (S_S).

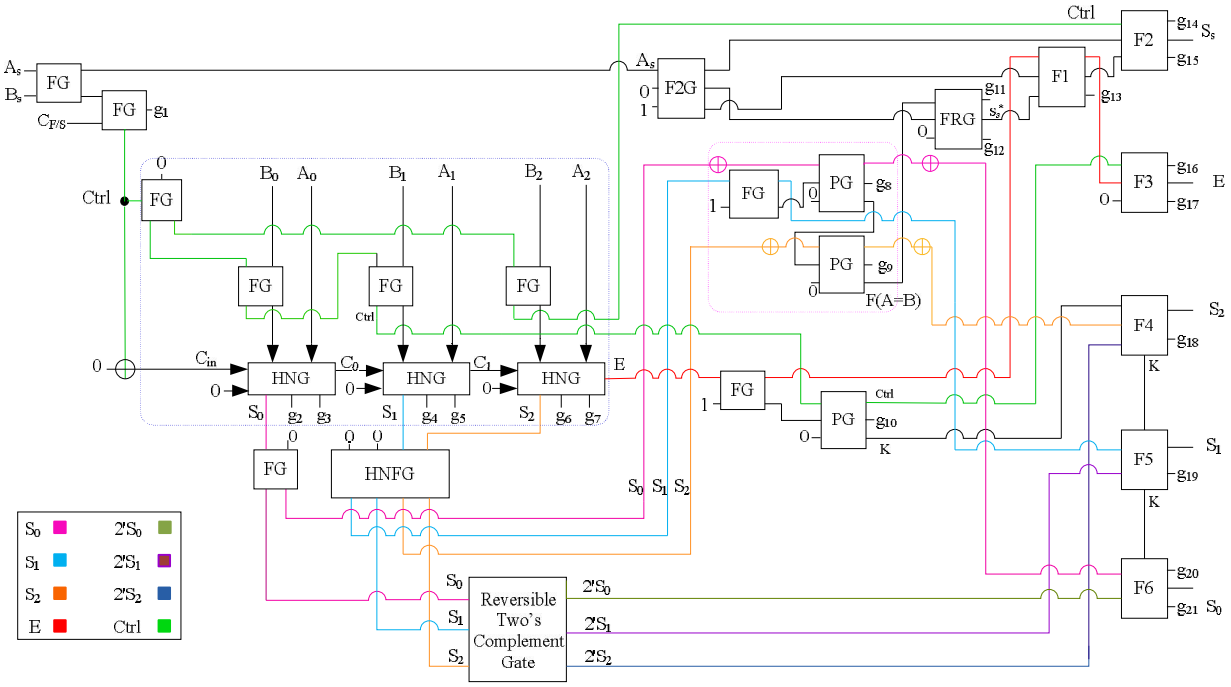

Figure 14. Proposed Four-bit Reversible Signed-magnitude Full Adder/Subtractor(design I)

In proposed Four-bit Reversible Signed-magnitude Full Adder/Subtractor, when Ctrl=0 overflow may occur, therefore because of this overflow, FRG gate (F3) is considered. It means that F3 is used for detecting overflow and obtaining the correct result for inputs in the range of [-7, 7]. K input is a control signal for three FRG gates (F4, F5 & F6) which are located in the right side and down position of the proposed circuit. If the K input is zero then the result ($S_2S_1S_0$) is equal to the number in S; otherwise, it is Two's complement of the value in S. logical equation (3) can be written for control K signal.

(3) $K = Ctrl \times \overline{E}$

According to the equation 3, K is only one in 10 state of the Table 3 and it is zero in rest of states.

3.7 Proposed Four-bit Reversible Signed-magnitude Adder/Subtractor with ADD/SUB Gate

This circuit(design II) has been implemented with ADD/SUB gates instead of HNG gates, so subtraction operation is not performed using two's complement method. The borrow output of this design is different from previous design. In this circuit if E is equal to one then A will be less than B otherwise A will be larger than or equal to B therefore the K control input is changed and obtained from equation (4).

(4) $K = \overline{(Ctrl \times E)}$

On the other hand, inputs of F1 in previous design is swapped, it means that in Ctrl E=10 state the S_S^* signal and Ctrl E=11 state $\overline{A}_S$ signal stand in final sign bit. Proposed Four-bit Reversible Signed-magnitude Adder/Subtractor with ADD/SUB Gates is shown in figure 15. A comparison between the two circuits for the Reversible Signed-magnitude Full Adder/Subtractor is shown in table 3.

Table 3. Comparison between Design I and design II

	NO. of gates	NO. of Constant inputs	NO. of Garbage outputs	Quantum Cost	Total Logical Calculation
Design I Figure 14	26	17	21	84	$53\alpha + 38\beta + 14\gamma$
Design II Figure 15	23	17	21	65+3(QC(ADD/SUB))	$55\alpha + 38\beta + 14\gamma$

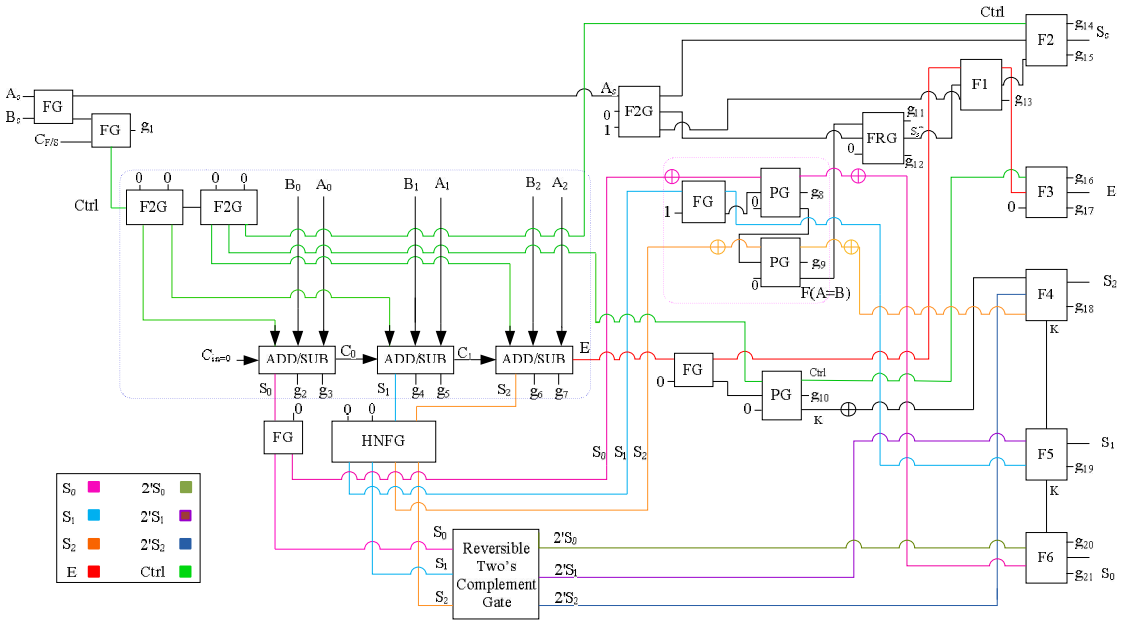

Figure 15. Proposed Four-bit Reversible Signed-magnitude Full Adder/Subtractor(design II)

Quantum model and Quantum cost of ADD/SUB gate has not been reported in (Emam and Elsayed, 2010), but according to its hardware complexity, the quantum cost of this gate is greater than HNG gate. The reversible circuit in design II is better than design I in terms of number of gates and design I is optimized in terms of quantum cost and hardware complexity in comparison with the reversible Signed-magnitude Full Adder/Subtractor in design II.

4. Simulation Results

Reversible proposed two's complement gate, Four-bit Signed-magnitude Adder/Subtractor with HNG gates and Four-bit Signed-magnitude Adder/Subtractor with ADD/SUB gates are implemented using VHDL code and simulated using Quartus Simulator. The proposed circuits are coded using Structural style. In this style, components are as the main blocks, it means that every reversible gate is a component. Simulation results of two's complement gate, Four-bit Signed-magnitude Adder/Subtractor with HNG gates and Four-bit Signed-magnitude Adder/Subtractor with ADD/SUB gate are shown in figures 16, 17, 18.

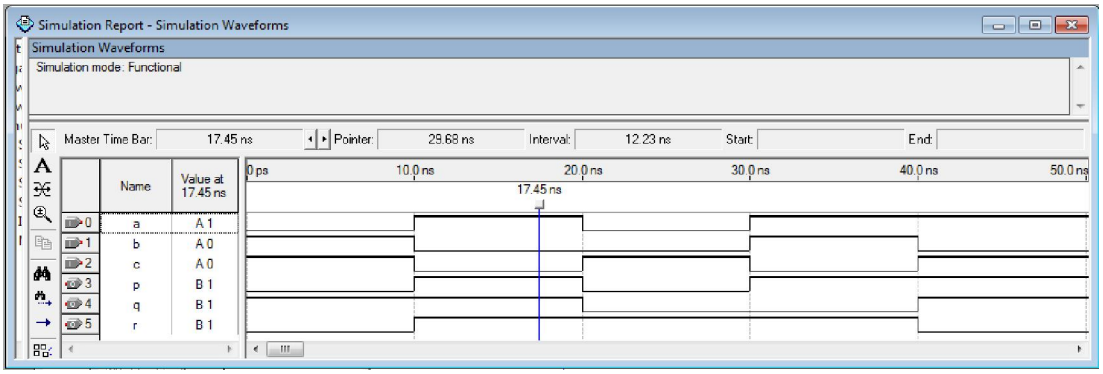

Figure 16. Simulation result of reversible two's complement gate

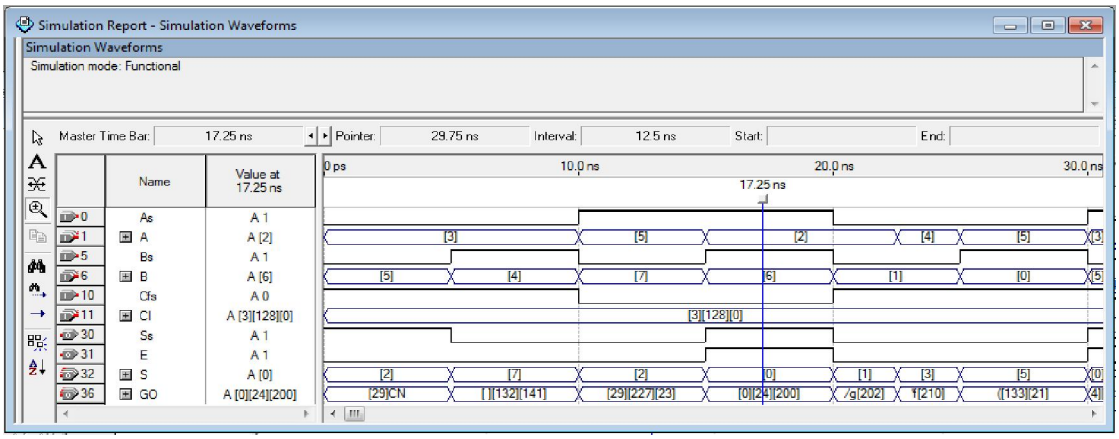

Figure 17. Simulation result of reversible Four-bit Signed-magnitude Adder/Subtractor with HNG gate

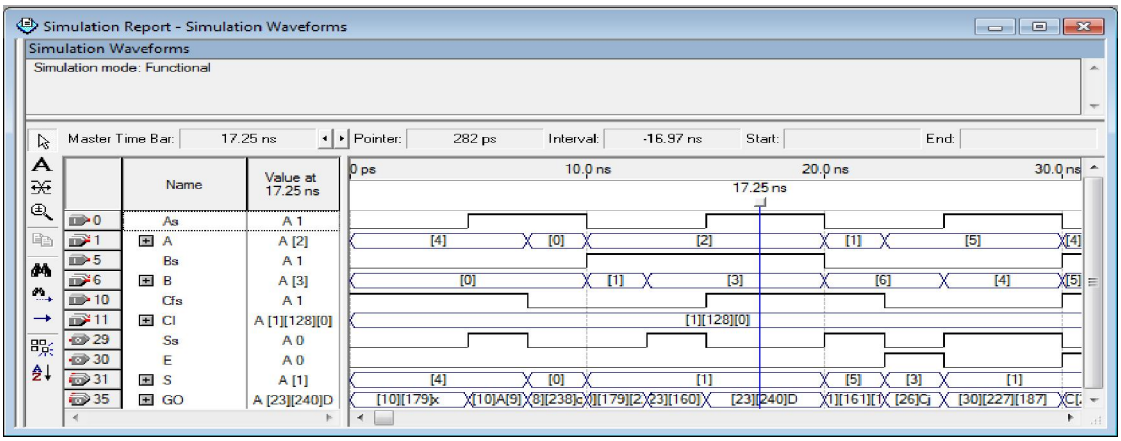

Figure 18. Simulation result of reversible Four-bit Signed-magnitude Adder/Subtractor with ADD/SUB gate

5. Conclusions and Future Works

In this paper, a new 3×3 reversible two's complement gate is presented. Proposed reversible two's complement gate can be used in implementation of the signed-magnitude Adder/Subtractor. For addition and Subtraction floating-point numbers is required to use signed-magnitude Adder/Subtractor because the mantissa in floating point is shown in signed-magnitude representation, Thus two designs for Reversible Four-bit Signed-magnitude Adder/Subtractor circuit has been proposed for the first time. Table 3 shows the results of two proposed schemes. According to obtained result from table 3 the first design with HNG gate is more optimal than second design with ADD/SUB gate in terms of Quantum cost and hardware complexity. If in designing circuit, minimum quantum cost was important then design I would be appreciate and if number of gates was important then design II must be used. Finally, the proposed circuits have been implemented using VHDL code and simulated using Quartus Simulator and obtained results of simulation shows the correct operation of circuits. This work is preface to design more complex and efficient signed-magnitude adder/subtractor.

As future works, some optimization techniques such as genetic algorithm may be used to reduce the quantum cost of the circuits. The proposed reversible Four-bit Signed-magnitude Adder and Subtractor can be generalized for reversible n-bit Signed-magnitude Adder/Subtractor. All the circuits have nanometric scales.

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The Lived Experience of Iranian Caregivers of Comatose Patients

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Abstract: It was to examine the lived experience of caregivers of comatose patients. Van Manen's conception of hermeneutic phenomenology with convenience or purposeful sampling of nurses and family members of teaching hospitals was used in Tehran in 2011. The data were collected through interviews. The gathered data were analyzed using Van Manen's phenomenology. The participants were 5 males and 5 females and working in critical care units between 6 and 23 years. 19 essential subthemes were elicited, were classified into 2 themes: Holistic care and Caregiver's characteristics. Therefore, caring experience of comatose patient was scientifically defined: Caring for a Comatose Patient is a holistic care that depends on caregiver's Characteristics. The trustworthiness of sub themes and themes were achieved in our study. ***Conclusion:*** Our findings will enable nurses to know what patients have experienced in coma, to give greater insight to what is the issue of being faced by the caregiver, to enhance insight can lead to improved practice through more sensitive relationship with the patients and more focused assessment of their needs, to achieve and create an assessment tool based on the findings of our study; it seems that the results can be used in this regard.

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Keywords: coma, qualitative research, lived experience, Van Manen, hermeneutic phenomenology

1. Introduction

Coma comes from the Greek word, ***Kuma*** that means deep sleep, with prolonged unconsciousness (Menck, 1998). There are 8 million head injuries in the USA yearly, which 700 thousands of the victims are hospitalized mostly in critical care units with intensive nursing care (Villanueva, 1999).

The novice nurses encounter with especial problems and challenges in caring of these patients with no previous experience. 73% of these nurses cannot communicate with comatose patients and feel unsafe and disappointed (Villanueva, 1997). On the other hand, 69% of them pay more attention to physiological and pathological aspects of these patients (Menck, 1998).

Novice nurses do not have the opportunity to practice the care giving role in comatose patient until it is upon them. In addition to the physical and emotional of caring for comatose patients, is very difficult. A nurse led support group focused on these aspects would give participants the opportunity to understand the transition and learn coping skills that would enable others to more successfully navigate their way through it.

The most important note is that the quality of care in comatose patients is the most significant criteria for evaluation of nursing care quality because this caring is long and very burdensome. This criterion is covered with transferring of nurse's experiences to other novice nurses.

Literature review

Two qualitative studies have been conducted regarding the experience of caring of comatose patients. Hence, the lack of qualitative study and a standard definition and research instrument for experience of caring of comatose patients, long and various research time periods, possible bias in data gathering or analysis, conducting studies in same research sites have resulted in in confidentiality of the studies' findings. Nevertheless, our findings have proved very helpful in improving nurses' quality care in comatose patients.

Villanueva (1999) studied on experience of critical care nurses who caring for patients in traumatic coma or pharmacological paralysis in university of Miami. Using grounded theory methodology to explore the experience registered nurses. After 16 interviews, data saturation was achieved. The core category was giving the patient a chance.

On the other study, (Menck, 1998) studied on the experience of caring when the patient is comatose in New Yourk University. The 5 registered nurses were interviewed. The nurse's experiences were dynamic and rewarding.

However; they, in their dissertation, worked on caring experience in critical care unit by grounded theory and case study which is very different from phenomenology. We used hermeneutic

phenomenology in our study and we think it is more specific than others.

Background in Iran

All teaching hospitals in Iran have only registered nurse, from novice to expert, according to the Iranian ministry of health, even in critical care units specially in caring of comatose patients; in addition, many patients have nursing care from the teaching health care facilities. On the one hand, hard working conditions and units overcrowding result in nurses' lack of experience in comatose caring patients. On the other hand, expert nurses who cannot transfer any caring experiences to novice nurses are employed in critical care units.

Regarding studies about coma in Iran, we don't have any qualitative study specially phenomenology design. Thus, in this study we aimed to examine the lived experience of caregivers of comatose patients and finally to define and transfer it to other nurses in Iran.

In addition to our professional grounding; Approximately, I spent 1 month in caring for my terminally ill wife and my father until they died of traumatic coma in 2008 and 2009. I also have experience in caring for comatose patients at ICUs for 4 years between 2003 and 2007. This interest eventually led to my doctoral studies and to my choice for the topic of study.

2. Material and Methods

Our worldview was reciprocal interaction. This worldview can better respond to questions of the nursing discipline (Fawcett 2005).

My interest in comatose patients' care giving began in 2008 during the process of caring for my father and in 2009 for my wife as they died of traumatic coma. The events and emotions encountered during those years of care giving had a deep and lasting effect on me and eventually led to my choice of this care giving as my phenomenon of interest while in postgraduate level. When I spoke with caregivers, I came from the perspective of one who had done care giving. Although my own care giving experiences would not be included in the data analysis process or results of the study, the existence of those experiences would be present in my ability to relate to the caregivers and in my thinking as I analyzed their interviews. In an attempt to identify my pre-existing ideas about my care giving for both my wife and my father, I kept fifty three pages of writing were produced between July 20, 2009 and April 10, 2010.

First of all, for orienting to the phenomenon, the phenomenological questions were formulated Working from a phenomenological perspective, the research question became "What is the lived experience of caring comatose patients?" For examining the lived experience, by continually searching for ways to deepen his or her understanding of the phenomenon, we tried to deepen our standing of the phenomenon by probing questions and field notes and certain observations.

Table 1: six themes of Van Manen hermeneutic phenomenology

Theme	Activities
1. Turning to the nature of lived experience	1. Orienting to the phenomenon 2. Formulating the phenomenological question 3. Explicating assumptions and pre-understandings
2. The existential investigation	4. Exploring the phenomenon: generating data a. Using personal experience as a starting point b. Tracing etymological sources c. Searching idiomatic phrases d. Obtaining experiential descriptions from subjects e. Locating experiential descriptions in literature, art, etc. 5. Consulting phenomenological literature
3. Phenomenological reflection	6. Conducting thematic analysis a. Uncovering thematic aspects in life world descriptions b. Isolating thematic statements c. Composing linguistic transformations d. Gleaning thematic descriptions from artistic sources 7. Determining essential themes
4. Phenomenological writing	8. Attending to the speaking of language 9. Varying the examples 10. Writing 11. Rewriting
5. Maintaining a strong and oriented relation	
6. Balancing the research context by considering parts and whole	

Table adapted from "Practicing Phenomenological Writing", Van Mannen, (1984)

We followed Van Manen's hermeneutic phenomenology (Van Mannen 1997):

Table 2: Participant's Characteristics changes or revisions, and to elicit any additional data the participant wished to contribute. This process continued with all 10 participants; data analysis was ongoing as the interview process progressed confidentiality.

Participants	Numbers	Sex	Marital Status	Age	Location of Living	Period of Caring	Educational Level	Occupation
Nurses	8	5 Males	7 Married	26-42	Tehran	6- 23 years	6 Bsc	6 Staff Nurse
		3 Femals	1 Single				2 Msc	2 Head Nurse
Family Members	2	Females	Single	40-42	Tehran	2- 7 months	Bsc	Teacher

For tracing the etymological source of the words associated with caring for a comatose, we follow and examine the etymology of "coma," "patient," "caregiver," "cares," and "experience" for creation of useful and obvious narratives. Then for having arisen from the lived experiences of people, we were searching idiomatic phrases for the informative nature of idiomatic.

In order to achieve experiential descriptions from participants, a convenience or purposeful sampling was used. The goal in sampling was to have a nurse and family member who were currently living the experience of caring for a comatose patient in hospital or home and who had done so for at least one time. Inclusion criterions were caregivers who had Persian language, had a communication with patient directly or indirectly and were volunteer and informed from critical wards or homes in Tehran hospitals.

An initial sample of 14 participants had been anticipated, however this number decreased throughout the research process. Data saturation was recognized when after interviewing 10 participants. Table 2 shows participant's characteristics.

The time and location of the interviews were determined at the convenience of the participants. Two of the interviews in the participants' homes and 8 were conducted in intensive care units. Only one interview with the one participant was conducted in the same location again. Informed consent was obtained after the participants were given time to carefully read the consent form and to ask any questions they had before signing it

The interviews were conducted face-to-face and were audio-tape recorded. Most of the interviews lasted 47 to 98 minutes. After each interview, I took notes in order to document my impressions of the meeting and to record non-verbal cues the participant demonstrated. Each audio-tape was transcribed verbatim by a paid transcriptionist (The transcriptionist signed a confidentiality statement and each transcription was checked for accuracy by me against the original audio-tape. For analysis, I read and listened to tape more and more, to make any

Table 2: Participant's Characteristics changes or revisions, and to elicit any additional data the participant wished to contribute. This process continued with all 10 participants; data analysis was ongoing as the interview process progressed confidentiality. Appropriate measures were taken to ensure the confidentiality of the participants and included the following steps. All audio-tapes, field notes, and typed transcriptions wrote and rewrote times by times, were identified only by use of codes.
For descriptions from artistic sources; the Brook's book "Comatose patient" and comatose patient films were included with the data analysis.

The process of uncovering thematic aspects began in the current research study when the interviews were conducted with caregivers having the experience of caring for comatose patients. Questions used on the interview guide were formulated to enable the participant to facilitate the participants' movement away from their preconceived notions of care giving to what presented itself to them on an intuitive and visceral level. When the interviews were completed, we wrote memos in which my impressions and thoughts about the interview were recorded. We referred to these memos periodically during the data analysis process to refresh my memory of the particular interview.

The selective or highlighting approach was implemented in this study so each transcription was then read carefully and all phrases and sentences relevant to the phenomenon were highlighted for further consideration. The highlighted parts of the interview were examined for the sub themes contained within them.
Through sensitivity to the lived experience of the participant as reported in the transcripts, I developed a dialogue with what was being said. The resulting sub themes were the interpretive product of that interaction. The sub themes were what were revealed to me in my interaction with the transcript.

Once the sub themes of the various transcripts were identified, we composed linguistic transformations of them. In this hermeneutic activity, we attempted to interpret the text and to move the language to a more universal level of abstraction while at the same time remaining faithful to the participant's lived experience.

In order to increase our understanding of a lived experience and that as such, it is an appropriate resource for phenomenological reflection. We argued each subtheme with all participants and validate them word by word in several sessions. The responses of each participant within an interview were examined for commonalities pointing at a sub theme for that participant. This process continued until all of the interviews had been analyzed and a list of sub themes from all of the participants had been elicited.

Ethical issues

The Research Council of Shahid Beheshti University of Medical Sciences that supervised and corroborated its ethical considerations approved the study. Before data collection was commenced, Entrance permission to critical care units was obtained from the hospital managers. A covering letter to all of the participants informed them regarding the study aim. They were assured of the authors' commitment to their anonymity and confidentiality from the data gathering to publication of results. Informed consent was obtained from the participants who agreed to participate in the research.

3. Results

At first; 53 sub themes were elicited and after 8 scientific sessions with the expert academic professors and 10 sessions with our 10 participants until only those that are 19 essential sub themes to the understanding of the phenomenon remain. These 19 sub themes are shown in table 3.

After elicitation of 19 sub themes, we find two themes after research team sessions: Holistic Care and Caregiver's Characteristics.

The *"Holistic care"* is one of our themes. This theme was consisted of 12 sub themes;

(1) Complete care: it is all of physiological cal, social and psychological of care. *Routine Job:* it refers to all of routines and works in wards and homes.

(2) Resuscitation effort: it contains of all attempts that participants do for return of patients to life like CPR.…

(3) Effective and Successful of job: our participants said that their caring is some time successful and effective and occasionally it is non useful and effective.

(4) Giving Hope to Family: all of nurses implied that hoping and hopness of patient' family is an important goal for them.

(5) Effective Relationship: the relationship among caregivers, patients and family of patients is the most significant factor in knowing of patients and his or her return to life.

(11) Certain and Burdensome Job: all of participants believed that caring of comatose patients is very hard, exhausting and the other hand, very sensitive and certain.

(13) Spiritual and Moral perception: our participants were praying for patients like read of Quran, asking of God for return of patients.

(15) Attention to patient: all of caregivers told me that we didn't forget the patient.

(16) Living with Patient: our caregivers were belonged to their patients and followed them in whole times and places.

(17) *Calm Death:* all of nurses implied that while we can't help them, we have to give them opportunity to die calmly.

(18) Respect to Human Dignity: all of caregivers told us, all of human rights and dignity are significant and every patient has living right, moral rights and like these.

Therefore the "*holistic care"* is a complete care with routine works. Every caregiver wants to care in holistic manner, has to take an effective, certain and burdensome effort for patient resuscitation. Perception of spiritual and moral aspects in these patients is one of parts of complete care and it needs respect to patient's human rights and in fact you have to live with your patients and never miss her or him at all. If a caregiver will care her or his patient completely, he or she must care until end of the life even calm death.

Some of the relevant quotations of holistic care come below:

Participants 1; …*when I come back to ward, I look for and ask about my patients especially when he or she isn't in bed* (***Living with Patient***)…. *When I care from a comatose patient, I try to maintain relationship with him or her by speakin and, touching* (***Effective Relationship***)…. *When our attempt is not useful, we have to give him or her time to live without intensity and disappointment* (***Calm Death***)…. *Looking at her or his face is not forgetful* (***Attention to patient***)…. *I want to see her or his family in order to know her or him* (***Effective Relationship***)….

Participant 5; ….*happiness in caring, hope of family, it helps us, better care* (***Giving Hope to Family***)….*the patient require respect, advocacy, rights; these are important* (***Respect to Human***

Dignity) *…. I think about my patients and his or her care even in my home (**Living with Patient**)…. I care from my patients according to the physician's orders and schedule of ward (**Routine Job**)…. When I deliver the schedule of my ward to another staff, I imply that my patient has gavages, please check it significantly and tell to her or his family about progress of her or his level of consciousness (**Attention to patient**)….*

The *"Caregiver's Characteristics"* is another theme. This theme is consisted of 7 sub themes;

(6) *Mutual Satisfaction:* it refers to satisfaction of caregivers, patients and families.

(7) *Caregiver's Depression and Disappointment:* when the comatose patient dies after whole of effort, the caregivers have a sense like depression and disappointment.

(8) *Caregiver's Hopefulness:* the caregivers say that if all of patients die, we select comatose patient again because we are hopeful.

(9) *Caregiver's Guilt:* when the patient dies, caregivers accuse themselves and think that are guilty.

(12) *Commitment and Responsibility to Care:* in comatose patient it is very different because patient in coma can't percept anything and complain from any mistake so the caregiver's responsibility is a vital and crucial.

(14) *Belief of Death:*, some of them believe death is in God' hand and human is not able to return the patient if God won't.

(19) *Compassion and Sympathetic sense:* caregivers say that the comatose patients are very solely and they don't have anybody and nurse is just his or her relative.

On the other hand, *caregiver's characteristics,* in fact these are the most effective factors on holistic care. These are features of every caregiver and holistic care alters beneath of them. Some caregivers percept his or her patient's satisfaction when they are pleasant themselves. Some participants have compassion and sympathetic sense because the comatose patients are solely, without significant relative. Some caregivers believe that the death isn't in human scope and in fact God can return the patient and sometimes he won't and we can't do anything at all.

Some of the relevant quotations of caregiver's characteristics come below:

Participant 8; …. *When my patients die or heard about their deat, I depressed (**Caregiver's Depression and Disappointment**)…. After death of my patient, I have a sense like guilt sense or like (**Caregiver's Guilt**) …. When I visit my patient, I percept my duties and attempt to care carefully (**Commitment and Responsibility to Care**)…. My colleagues in the hospital and I try to understand the patient's satisfaction, it is very hard but it is fiseable (**Mutual Satisfaction**)…. Actually I find out the satisfaction in my heart when the patient is satisfied (**Mutual Satisfaction**)…. When my patient return alive and became conscious, I have satisfied more and more (**Mutual Satisfaction**)….I begin CPR but he or she dies and, and I know God carry him or her sole (**Belief of Death**)….*

Participant 10; …. *God acts like an angel, he can carry or take patient's sole (**Belief of Death**)… in fact comatose patient is very single, very solely and doesn't have anybody (**Compassion and Sympathetic sense**)…. If all of my patients die, I continue my care and attempt to rescue the rest of them (**Caregiver's Hopefulness**)…. When I came in nursing, I promised that will attempt and work in hard situation and coma is one of them (**Commitment and Responsibility to Care**)…. If my patient will be worst, I have been disappointing (**Caregiver's Depression and Disappointment**)…. I see my patient's sole in ward at nights and I believe there is (**Belief of Death**)…. My colleagues are satisfied from my care and I care better (**Mutual Satisfaction**)…. The patient's family asks about patient and the message of death, it is very bad and I will be depressed (**Caregiver's Depression and Disappointment**)….*

We consider these sub themes and two themes as a whole and define the caring experience of comatose patient. We know that without any sub theme, we can't define our lived experience and the other hand, every one of 19 sub themes, can't define lived experience solely. However, we define the caring experience of comatose patient with entire 19 sub themes and 2 themes in a scientific way: *The Caring of Comatose Patient is a Holistic care that is dependent to caregiver's Characteristics.*

4. Discussions

Villanueva (1997), in her dissertation, worked on caring experience in critical care unit by grounded theory which is very different from phenomenology. We used hermeneutic phenomenology in our study and we think it is more specific than grounded theory. In this study, participants included 16 nurses and we got saturation with 8 nurses and 2 family members.

Table 3: 19 essential subthemes in caring for comatose patients included

Themes	Sub Themes	Sub themes
Holistic care	(1) Complete Care	(11) Certain and Burdensome Job
	(2) Routine Job	(13) Spiritual and Moral perception
	(3) Resuscitation Effort	(15) Attention to patient
	(4) Effective and successful job	(16) Living with Patient
	(5) Giving Hope to Family	(17) Calm death
	(6) Effective Relationship	(18) Respect to Human Dignity
Caregiver's characteristics	(7) Mutual Satisfaction	*(12) Commitment and Responsibility to Care
	(8) Caregiver's Depression and Disappointment	(14) Belief of Death
	(9) Caregiver's Hopefulness	(19) Compassion and Sympathetic sense
	(10) Caregiver's Guilt	

( ) number of subthemes,
* Most frequent sub theme.

The her core category, giving the patient a chance and the subcategories were learning about the patient, maintaining and monitoring, talking to patient, working with families, struggling with dilemma and personalizing the experience. Factors influencing on them were identified such as the acuity of the patient, experience level of the nurse and the presence or absence of family member or significant others.

The subtheme of *Resuscitation Effort* was also found in Villanueva's study (Villanueva, 1997) as well as effective relationship and attention to the patient as themes. We found commitment and responsibility to care as a frequent subtheme.. She emphasized on the nurses' experience variations as the most effective factor on themes but we found effective and mutual relationship with comatose patients as the most significant factor.

In hence, the limitations of this study involved using registered nurses from one neuroscience intensive care unit; where the study was conducted there was no other level I trauma center with a neuroscience intensive care unit. The population for this study was limited to the unresponsive patient with the etiology of trauma. Race, gender and physical appearance did not emerge as factors that influenced on this experience. Villanueva only interviewed with nurses and didn't have any family member. In our study, there were not these limitations.

On the other study, (Menck, 1998) studied on caring experience of comatose patients with qualitative method along with case study. 5 nurses were interviewed and after data collection and analysis, the experience was found to be dynamic, energetic and holistic. We also found holistic care as a theme because the caring of comatose patient is complete and multidimensional and it is better to be called Holistic Care. One of the subcategories of holistic care was routine job consisting of physical and relationship aspects of patient according to caregiver's experience, Believed that this experience is not routine or mechanical but relevant to rigorous knowledge. In her study, role of palpation, conversation, mobility of limbs and certain attention to physical and psychological aspects of comatose patients were the most significant factors in caring and, in our study; caregiver's characteristics consisted of these aspects. Menck (1998) concluded that quality of care in comatose patients is the most significant criteria for evaluation of nursing care quality because caring is long and very burdensome. Our findings are in accordance with her because caring for comatose patients needs tactfulness, vigilance, high knowledge, excellent relationship and good perception. In this study, the participants did not find comatose persons very different from other patients but was invert in our study. In our study, the importance of touching, talking to, gently moving extremities, paying attention to minute details and finally knowing the patient was mentioned. In addition in our study, psychosomatosocial, spiritual and moral aspects of caring were important.

In her results; Technology and physical care were part of the job and not discussed as heavy or troublesome. Most participants said that this care for comatose patients took a long time like our participants.

In two studies; the goal of these caring experiences included being able to practice nursing at its full potential and we believed that novice nurses require them. The caring for the comatose patient was challenging, rewarding and an intensely rich and humanistic experience in these studies and in our study, it was hard and bothersome.

Their limitations consisted of: participants were 5 women who were similar in their cultural background, education, geographical location and experiences. No predictions or interventions, with only one investigator, unconscious biases were possible and little room for documenting the nurse's experiences. We didn't have these problems. These studies define the caring experience but we offered a certain and complete definition.

Finally; we assessed rigor of our data significantly. The second author observed the four interviews and supervised the transcribing process. The research nurses also recorded observational data for each participant and another person transcribed the interviews. The quality of interviews and transcriptions was ensured by the first author as author checked each transcribed interview for accuracy and integrated the observational data into final data files.

The first and second author completed the first draft of data analysis individually. To appraise the credibility of data analysis, numerous discussions continued until agreements were achieved about each aspect of the process. An expert in the phenomenological method reviewed the analysis of data and concluded that appropriate procedures had been followed. The researchers also discussed the final data analysis with two expert researchers who considered the data analysis valid. Finally, we compared the findings and integrated the bracketed knowledge and relevant literature.

Conclusion

Caring is an ancient and universal process that promotes the mutual growth of the participants. In everyday life in connotes a gentle concern and action taking place with and among living creatures, ideas, or objects. For centuries, there has been a caring relationship between caregivers and the suffering and the helpless. Caring begins when the caregivers and patients come together and, through communication, develops a relationship concerned with the patient's health experience.

We sought for the caregiver's perception of caring in one of the most challenging experiences caring for a comatose patient. It is a unique experience which presents caregivers with a number of challenges.

We meet these challenges in various ways and will put these experiences in an instrument for evaluation of caring in future research. As a result, it is very useful both for caregivers and patients.

The crucial point of this study was to uncover the caregiver's meaning of caring as an experience embedded in practice. The ability of our study to obtain meaning within context is essential in understanding the experience of comatose patient caring in its fullness.

Limitations and Implications

First of all, there is not new reference for qualitative research about comatose patient's care and we couldn't access to them.

We couldn't find more family member but we take saturation with these problems, interrupting of one interview by workload and the noise in the wards interfering with the participant's concentration. Designing a study with more family members and utilizing of grounded theory for explanation of caring process for these patients in Iran are highly recommended.

However; our results are useful for arising of ability of nurses to know what patients have experienced in coma and to give greater insight to caregivers. It results in improving practice through more sensitive relationship with the patients and more focused assessment of their needs.

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People Counting in Extremely Dense Crowd using Blob Size Optimization

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Abstract: Estimating Crowd density and counting people is an important factor in crowd management. The increase of number of people in small areas may create problems like physical injury and fatalities. Hence early detection of the crowd can avoid these problems. Counting of the people moving in the crowd can provide information about the blockage at some point or even stampede. In this paper, we have proposed a framework to count people in the extremely dense crowd where people are moving at different speeds. Foreground segmentation is done by various methods of background subtraction namely, approximate median, and frame difference and mixture of Gaussian method. Time complexity is calculated for these techniques and approximate median technique is selected which fast and accurate. Blob analysis is done to count the people in the crowd and blob area is optimized to get the best counting accuracy. Proposed framework is analyzed for three videos from Al-Haram mosque and people counting accuracy is found to be more than 96% in all three videos**.**
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Keywords: People Counting; Extremely dense crowd; Blob Analysis; Foreground Segmentation

1. Introduction

As the population of the world is growing day by day, maintaining the public order in the crowded areas of the big cities is getting very important. Some examples are Airports, railway stations, carnivals, concerts and sports events. Extensive use of closed circuit monitoring system is in place in major cities. Moreover, estimation of crowd or number of people attending certain event is also becoming important for government agencies, public opinion making and news channels. Hence lot of research is being done in automating the process of estimation and management of crowd using visual cameras, thermal imaging or other sensors placed at the entry points. Crowd management during Ramadan and Hajj at the Holy Mosque in Makkah is a daunting task. Tremendous effort from the security staff is required to manage the huge crowd peacefully and smoothly. In the last decade, due to low cost of cameras, lots of cameras were used for the surveillance of public places.

Manual monitoring of crowd is done by putting many surveillance cameras and some observers monitor the crowd density and their movement. In this scenario, the cost of surveillance is very high. Alertness of the observers is an important factor in good surveillance. As the working hours increases as the case of Masjid-e-Haram, fatigue and stress of the observer increases degrading their performance. The importance and demand for automated tools to manage and analyze crowd behavior and dynamics grows day by day as the population increases. Major works started in early 1990s as researchers employed various technologies and techniques to come up with different solutions to problems.

Most of the research in the field of crowd density estimation has focused on either segmentation of people or head counts, or based on texture analysis or wavelet descriptors. Some research is related to removing the background area from the foreground and then crowd density is estimated based on the foreground area assumed to be occupied by the people.

(Zhao et al 2003) proposed Bayesian model based segmentation to segment and count people but this method is not appropriate for high density crowds. (Yoshinaga et al 2010) proposed blob features of moving objects to eliminate background and shadow from the image. For each blob of moving people, numbers of pedestrians are estimated by using neural networks. They have shown that accuracy of 80% can be achieved by this method in the real life scenarios where maximum numbers of pedestrians are 30 in a single frame.

(Xiaohua et al 2005) showed classification accuracy of 95% when crowd density is classified into four classes by using wavelet descriptors. Classification is done by support vector machine. Their method is good for estimation of crowd density for moderate crowd density.

(Ma et al 2008) used texture descriptors called advanced local binary pattern descriptors to estimate crowd density estimation. They have calculated LBP from the blocks of the image and tested on small database of images for automatic

surveillance. They divide the image into squares, bottom squares are bigger, upper ones are half the size. The ground truth is manually labeled for each square, low for 0-0.5 persons in a square etc. with 5 categories in total. They classify the images cells (squares) using kmeans clusters and the distance is computed using their pattern descriptor. Once the training of cells is done and clusters are formed, they test data for each cell, they find the texture and put that in a group, hence adding all the squares they get crowd estimation. This is yet another example of using texture. May not be suitable for generic apps, but it seems to work well once trained.

Terada et al. proposed a system that calculate the directional movement of the crowd and count the people as they cross some virtual line (Terada et al 1999). (Hashimoto et al 1997) used specialized imaging system using infra-red imaging to count the people in the crowd. (Davies et al 1995) have discussed in detail the concept of crowd monitoring using image processing through visual cameras. (Roqueiro et al 2007) used simple background subtraction from the static images to estimate the crowd density.

Some other researchers (Velastin et al 1993, 1994) have also used the concept of background removal to estimate the crowd area. Computer vision algorithms were employed to monitor crowd densities and behaviors with various degrees of accuracies. (Velastin et al 1993, 1994) dealt with crowd densities and count, and motion estimation. They fixed an area to observe, and then asked people to walk past it normally in different number, they have the background image (empty), then they counted the people manually in each image, and got the background subtracted image, and the thin edge images of people, they plotted the number of people vs. positive pixels and make a graph. Using a kalman filter they combined the line thinning and blob methods and ran automated trials. This took care of the density vs. the people count in a confined area. To measure motion they used optic flow, they assumed that if the motion stops something has happened, so we get the people present from the BG subtracted image, and flow from optic flow. They tend to use a flow smoothness technique for the objects that move more than one pixel between processed frames.

(Reisman et al 2004) used a forward facing camera mounted on the car to detect crowd of pedestrians. It assumes that a camera in a moving forward car will have outward optic flow. Any moving objects will produce inward optic flow hence they detect the motion. They also use classifiers to distinguish between human and cars. They use a variant of Hough line transform to detect the disturbances in the optic flow due to moving objects. The crowd is not assumed to be traveling in a particular direction and hence if moving in a haphazard manner, optic flow cannot help in this case.

To estimate the crowd density using image processing, many researchers have used the information of texture, edges or some global or local features (Marana et al 1997, Ma et al 2004, Lin et al 2001). (Marana et al 1997) argued that low density crowd images have course texture and high density crowd images have fine texture, they computed the texture using Gray Level Dependence Matrix at four angles computing contrast, homogeneity, energy and entropy to form a 16 parameter vector, and then trained SOM neural network on the densities and the vector relationships. The results were not too impressive in the low density scenarios, but decent in high density. This was supervised learning so different for each scenario/camera view.

(Ma et al 2004) argues that the perspective distortions in images for pixel based crowd estimation are either incorrect or not done well, they propose a geometric correction technique, and they argue that the correction depends on y-axis only. Hence if a human is standing upright, pixels on his feet have a scale, and all the pixels on his body has the same scale as his distance from the camera is same. They use a simple foreground pixel detection technique using some masks and adaptive area growing as well. They integrate the GC into their pixel count using a lookup table. They assume each person as a rectangle changing in size with y value, and then consider all positive pixels in that rectangle as that person. The authors point out many flaws in past research works but this approach may fail when dealing with high crown density when people occlude others partially and completely

Another work (Lin et al 2001) trained support vector machines using HAAR transform to identify heads of people after histogram equalization to eliminate illumination changes in a crowd in order to count them and estimate the densities. It used 16x16 pixel head templates and resized the image to get heads of various sizes. In Sheng's paper, none of the persons are wearing anything on their heads, in Masjid-e-Haram people may wear caps, and hijabs and this head classifier will fail.

Some researchers (Marana et al 1998a, 1998b, Ma et al 2008) have used texture analysis to extract certain features from the images and have used neural networks to estimate the crowd. (Cho et al 1998, 1999) and (Huang et al 2002) blended the concept of image processing and neural networks to estimate and count the crowd of people.

(Yang et al 2003) have used group of image sensors to segment the foreground objects from background scene to count the approximate number of

people in the crowd in a particular scene. (Xiaohua et al 2006) have used wavelets to extract the features from the images for the crowd estimation

(Rodueiro et al 2007) uses the fore ground pixels and finds them using a Median Background computing technique. Foreground pixels are found by applying a threshold and then morphological operations are done to smooth the results. They ignore zones by masking area that have motion but not interesting like road (cars) etc. They apply classification algorithms like SVM, k-nearest, PNN, BPNN to classify the images in 2 categories first, zero persons and one and more persons. On more than zero people's categories it again applies the classification techniques to find the number of people in the scene. They train these classifiers on 70% of the images and test them on the 30% of the remaining images. The median filters are applied on the sequence of image results to get rid of the spiky errors. Also they use assorted grid to see if the accuracy increases.

Recently many researchers have started work on counting people and crowd estimation using infra-red sensors as the cost of the sensors is going down and installation of these cameras are become affordable. Moreover, these cameras can be used in total darkness and the images obtained from these cameras are invariant to the different colors of cloths, and different level of illuminations. Andersson et al. [24] have used thermal infra-red sensors in the long wave infra-red band and visual cameras and proposed the concept of sensor fusion to predict the crowd behavior. (Teixeira et al 2007) proposed lightweight camera sensor nodes to count the people in the indoor environment based on motion histogram. Recently many infra-red sensors specifically designed for people counting are available in the market (25, 26).

Not many papers are published related to crowd estimation or people counting in Masid-e-Haram. (Hussain et al 2011) have proposed pixel based crowd density estimation system. They have used crowd foreground blobs to classify the crowd into five ranges from very low to very high using neural networks. (Jasy et al 2010) have proposed a generalized framework for crowd surveillance research in the context of crowd in Masjid-e-Haram. (Sarmady et al 2011) has proposed an interesting model for circular tawaf around Kaaba.

2. Material and Methods

Crowd density estimation is an important tool in good crowd management. Moving crowd may create situations where people may get fatal injuries. Early detection of crowd motion and people counts can avoid serious situations and fatalities. Therefore, crowd detection and estimation has been the area of interest of most of computer scientist and researchers. As a solution, automatic crowd detection and monitoring methods based on computer vision technology were proposed to overcome the weaknesses of manual and traditional surveillance systems. Figure 1 explains the methodology, video is streamed from the camera to the system and system processes the video frame by frame. From every frame, foreground is segmented which represents the moving objects in the frame. In our particular application, moving objects are human beings. Blob analysis is done on the foreground to find out the independent blobs of a particular size which later counted to find out the total number of people in the frame who are in motion.

A. Foreground segmentation

Identifying moving objects in video sequence is a fundamental and critical task in video surveillance, human detection and tracking, and gesture recognition in human-machine interface. Foreground segmentation is an important pre-processing step for detecting the moving objects from the video. Pixels in the current frame that deviate significantly from the background are considered to be moving objects. These foreground pixels are further processed for object localization and tracking. Frame difference technique is the simplest form of foreground segmentation based on the difference of two consecutive frames by applying a threshold value to decide between background pixel and foreground pixel (Gonzalez and Wood 1992). This technique is prone to change in the illumination conditions of the video. Many methods exist for foreground segmentation, each with different strengths and weaknesses in terms of performance and computational requirements. (Piccardi 2004) has provided a good survey by comparing different background subtraction methods. Many background extraction methods do not perform well in different lightening conditions. It is claimed in (stauffer and Grimson 1999) that if the background is not visible for most of the time then average or median filtering may fails to extract the background. Hence, Mixture of Gaussians method is robust in the case when background is multi-modal. (Stauffer et al 1999) proposed Mixture of Gaussian model which is stable and robust and good in non-stationary backgrounds. High computational complexity of these algorithms makes them not suitable for online video processing. Hence, we are interested in relatively faster and simple foreground segmentation techniques which can give us sufficient segmentation accuracy. Hence, we have analyzed the performance of the following two techniques in our particular application where high density crowd is moving in congestion.

- Frame Difference

- Approximate Median

Frame Difference:

Frame difference is the simplest form of background subtraction. The current frame is subtracted from the previous frame. If the resultant difference in the pixel values is greater than a threshold T_s, the pixel of the frame is considered to be part of the foreground as given below,

$$\left| f_i - f_{i-1} \right| > T_s \quad (1)$$

Where f_i is the pixel value of the i^{th} frame in the video.

Approximate Median

Median filter is designed by buffering N number of frames and median of these frames are calculated and a threshold is applied to detect the background of the video. This method is very effective but many frames have to be stored to calculate the median frame. In median filtering, the previous N frames of video are stored in the buffer and the background frame is calculated as the median of buffered frames. Then the background frame is subtracted from the current frame to find out the foreground pixels.

The approximate median method (McFarlane and Schofield 1995) gives a good alternate solution to the buffering the N frames in the memory to calculate the median frame. The first frame is taken as the background frame and for the next coming frames; if the pixel value of the current frame is greater than the background pixel then the pixel value of the background image is incremented by 1. If the pixel value of the current frame is less than the background pixel value then the pixel value of the background pixel is decremented by 1. Hence it is assumed that after sufficient number of frames, the background image will converge to the true median image of the video.

B. Blob Area Optimization

Blobs are the connected regions in a binary image. Blob analysis process is aimed at detecting point and/or regions in the image that differ in properties like brightness or area etc. For blob detection, image is first converted to binary image. Then next step is finding the connected components in the binary image. We have used "***bwconncomp***" and "***regionprops***" functions of Image Processing toolbox of Matlab (34). Following are the steps for finding the connected components in the binary image.

1. Search the unlabeled pixel, *p*
2. Label all the pixels in the connected component containing *p* by using flood fill algorithm.
3. Repeat the step 1 and 2 until all the pixels are labeled.

After finding connected components in binary image, the next step is to measure the properties of each connected component (object) in a binary image. In this paper, we are interested in measuring the 'Area' of each connected components. Area is the number of pixels in the region. Each binary image has a lot of connected components of variable size. We are interested in finding those connected components having area greater than some specific value. Area of the connected component differs depending upon the distance of camera from the scene. If the distance between the camera and crowd is less, greater will be number of pixels in a connected component and hence greater will be the blob size of the object. Hence the first step in people counting is to decide the optimal area of connected component. For this purpose, we have used four initial frames whose ground truth is available. In the iterative approach, we change the area of the blob size and count the people. This count is then compared with the ground truth of the frame (actual number of people in the frame). For each frame, optimal area is found for which the people count error was minimum. The whole framework is shown in figure 4. For each initial frame, foreground segmentation is done and all connected components are calculated. In the next step, blob area is varied and blobs are counted whose area is greater than the particular blob area. This blob count is compared with the number of people in the frame. The error between the blob count and actual number of people in the frame is calculated for the whole range of blob area. Same procedure is done for all four initial frames and optimal blob area is found for which the counting error between the number of blobs and the actual people in the frames is minimized. This optimal blob area is used to count in the people in all the frames of the video. To assess the performance of the proposed framework, three videos in the mattaf area of Al-Haram Mosque is recorded where extremely dense crowd is doing tawaf of the Kaaba. In sample frame of VD1, there is a rich background, and many people are entering the tawaf area and leaving this area from different sides. Some people are standing and praying which are in relatively very slow motion while remaining on their place of prayer. In the tawaf area (middle area) many people are moving at different speed. At the outer circle they are moving fast whereas in the inner circle the motion is slow. Frame rate of the video is 50 frames per second and frame resolution is 1920 × 1080. The video contains more than 10,000 frames. Since there are more than 2500 people in motion in every frame so it is extremely difficult to count in all the 10,000 frames. Moreover, in one second there are 50 frames and we expect that not much change occurs from one frame to the other frame. Hence we have decided the count the

people in motion in 100 frames at almost equal interval of about two seconds. We assume that the error in the people counting occurring in these 100 frames will be the same in all 10,000 frames.

C. Description of Video for the testing of the proposed framework

In video VD2, there is a close up look of the people doing tawaf near Kaaba. Some people in green dress are cleaning the place, some security staff is there controlling the crowd and people are moving around in a very dense fashion. This video consists of 76 frames and ground truth of 12 frames is calculated out of which four frames will be used to optimize the parameters and eight frames will be used to assess the performance of the proposed framework.

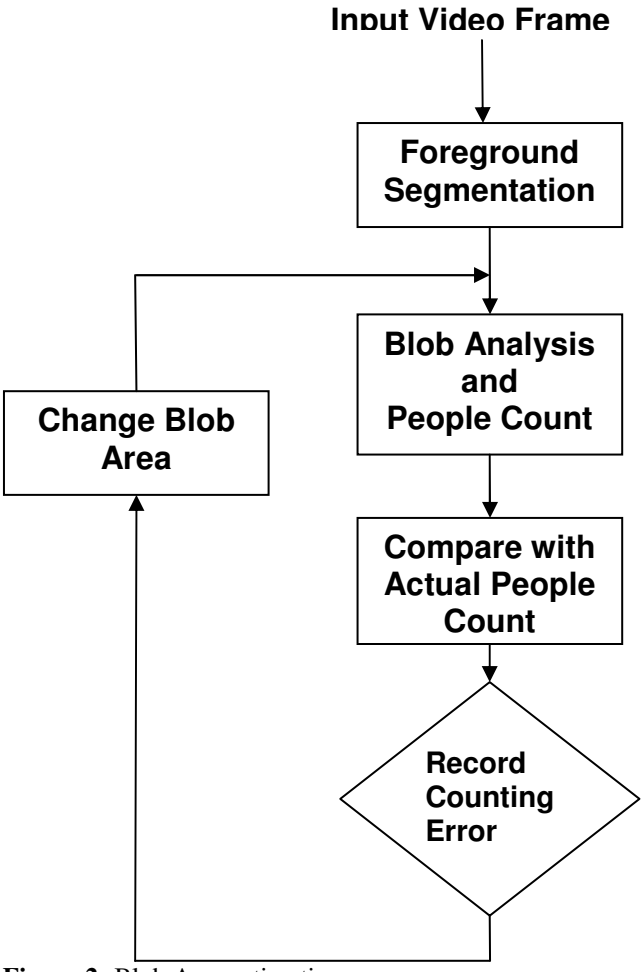


Figure 2: Blob Area estimation

Video VD3 is again a close up look of people doing tawaf by a different angle of camera. The crowd is again extremely dense. In this video most of the people are wearing Ehram (Two pieces of cloths wrapped around the body with one shoulder naked). This is a typical scenario during umrah and hajj. This video also contains 76 frames out of which ground truth of 13 frames are calculated to test the accuracy of people counting. So all three videos carry different setting and different scenarios and are good for testing the people counting algorithms.

3. Results

Foreground segmentation is done with different level of threshold values using approximate median. Threshold effect on foreground segmentation is very similar to the frame difference method. For low threshold values, it is difficult to differentiate among people in the closed vicinity and for very high threshold value, some people will be skipped. But one very important thing that can be observed in the figure that by varying the threshold value, a proper threshold value can be selected which can generate blobs distinguishing the people in the closed vicinity. By visual inspection of four initial frames it is predicted that optimal threshold value lies between 40 and 60 approximately. Foreground segmentation by approximate median at threshold level of 50 is shown in Figure 3.

A. Timing Analysis of Different Foreground segmentation methods

To study the time complexity of the foreground estimation methods described above, frame difference, approximate median and mixture of Guassian methods are used to extract the foreground frame for 100 frames of the video and the time is recorded as average frame processing time and is recorded in Table 1.

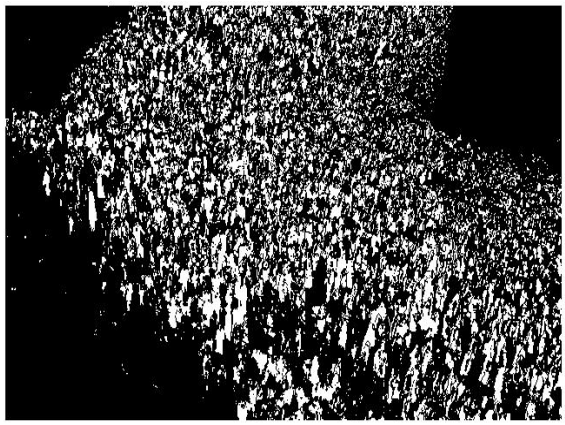


Figure 3: Foreground segmentation by approximate median method

The system used for calculating the time complexity is HP Compaq 8100, Processor is Intel(R) Core(TM) i5 CPU 2.80GHz, with 4GB RAM. All calculations are done in the Matlab 2011a environment. It can be seen that frame difference

method is fastest and approximate median method takes almost double frame processing time. Mixture of Gaussian method is very expensive and is out of question for online video processing. Hence, we will compare frame difference method and approximate median method for the foreground extraction in terms of people counting accuracy.

Table 1: Time Complexity of Foreground Extraction Methods

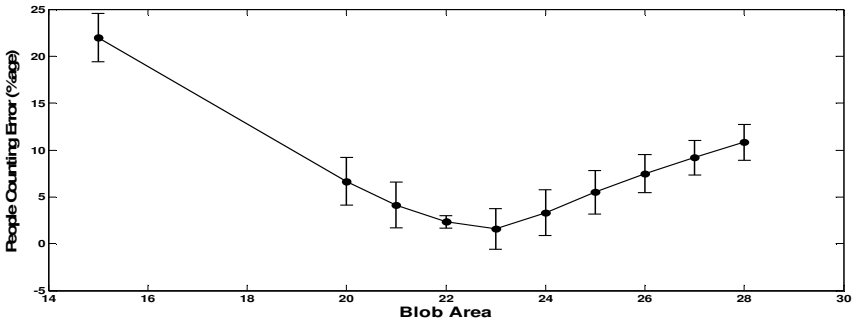
	Average Frame Processing Time (Seconds) Mean ± Standard deviation
Approximate Median	**0.249 ± 0.013**
Frame Difference	**0.137 ± 0.008**
Mixture of Gaussians	**62.37 ± 2.93**

After foreground segmentation, the next step is finding the optimal area of blobs. As described in section A, the optimal threshold value lies between 40 and 60, so the threshold value is selected to be 50 to find the optimal value of the blob area.

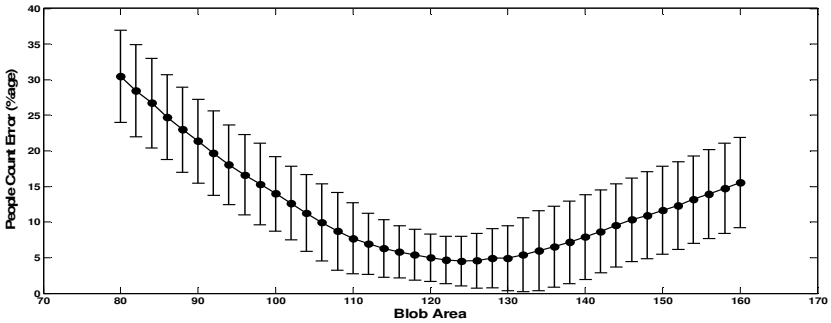
A range of bob area is defined manually and counting error is calculated by varying the blob area. Average and standard deviation of the error between the people count using the blob area and the actual number of people in all four frames is plotted in figure 4 versus the blob area. In Figure 4(a), mean and standard deviation of the counting error is plotted for VD1. It can be observed from the figure that the error is minimum for the blob area equals to 23. Hence blob area of 23 is taken to calculate the number of people in all the frames of VD1. Figure 4(b) shows the plot of error versus blob area for the video VD2. The best blob area is found to be 125 for which the error is minimized. Since the size of people is this video is larger as compared to VD1, the optimal blob area is also large. Counting error for VD3 is plotted in figure 4(c) and optimal blob area is found to be 110.

B. Optimization of Threshold Value

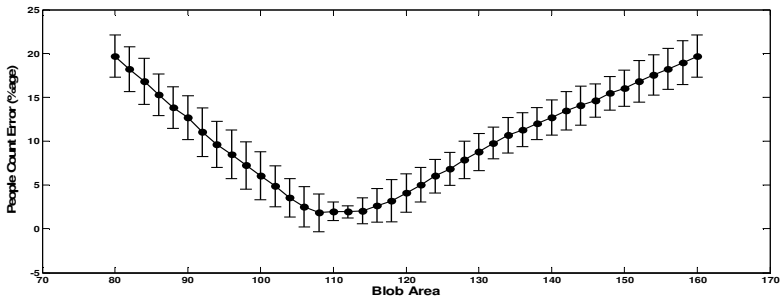
It is very important to select the proper value of the threshold so that foreground segmentation can be achieved in the optimal way. For this purpose, initial four frames are selected with the actual people count in the frames from VD1. Blob area as discussed in section B, is selected as 23 for VD1. For every threshold value, people are counted and compared with the ground truth (Actual number of people moving in the frame). Average error in the people count is plotted in Figure 5 with the standard deviation as function of threshold value for approximate median. Optimal threshold value is found to be 50 on which we have got the minimum error.



(a) Video VD1



(b) Video VD2



(c) Video VD3

Figure 4: Optimization of blob area for four different frames for videos VD1, VD2, VD3

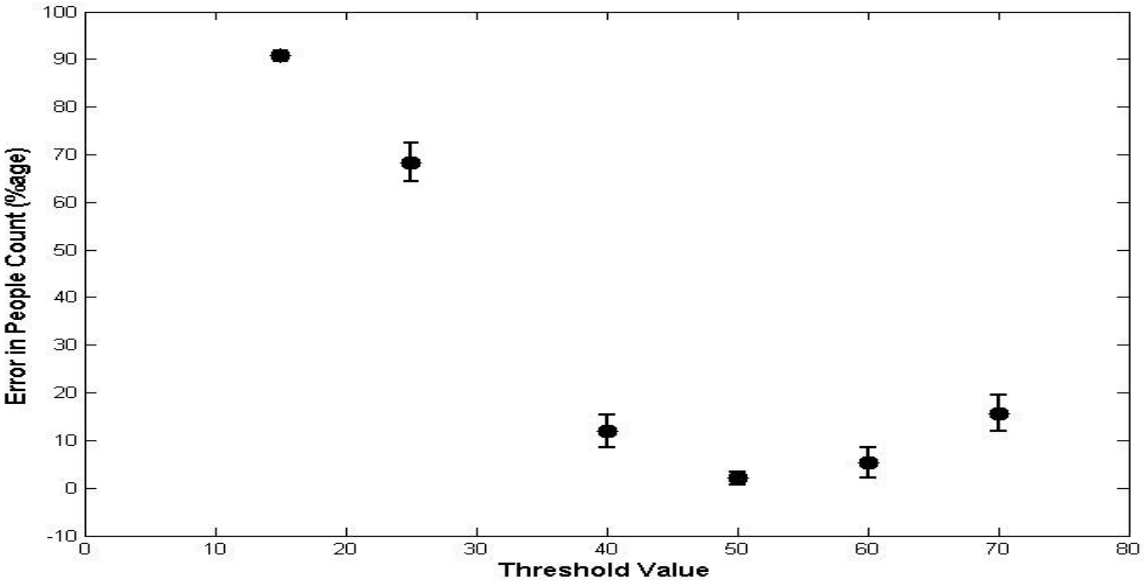


Figure 5: Average counting error for different Threshold values using approximate median method

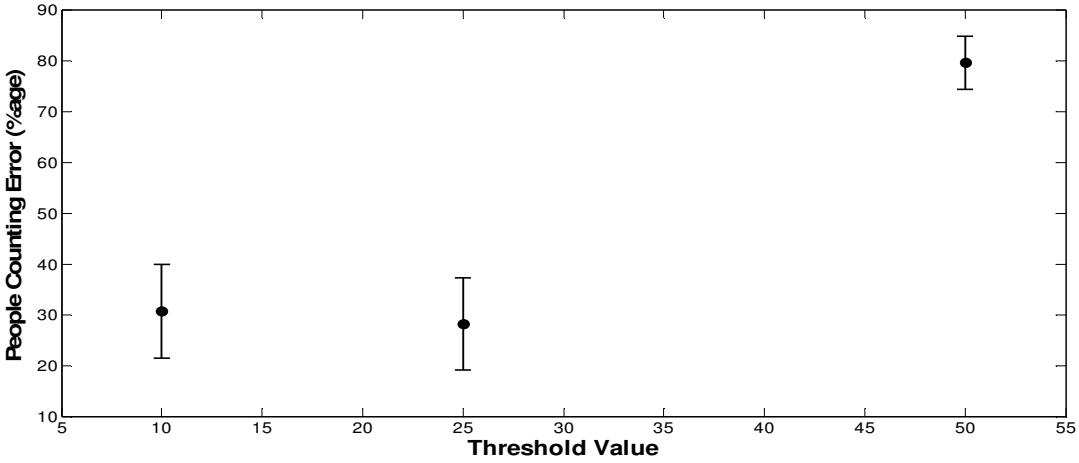


Figure 6: Average counting error for different Threshold values using frame difference method

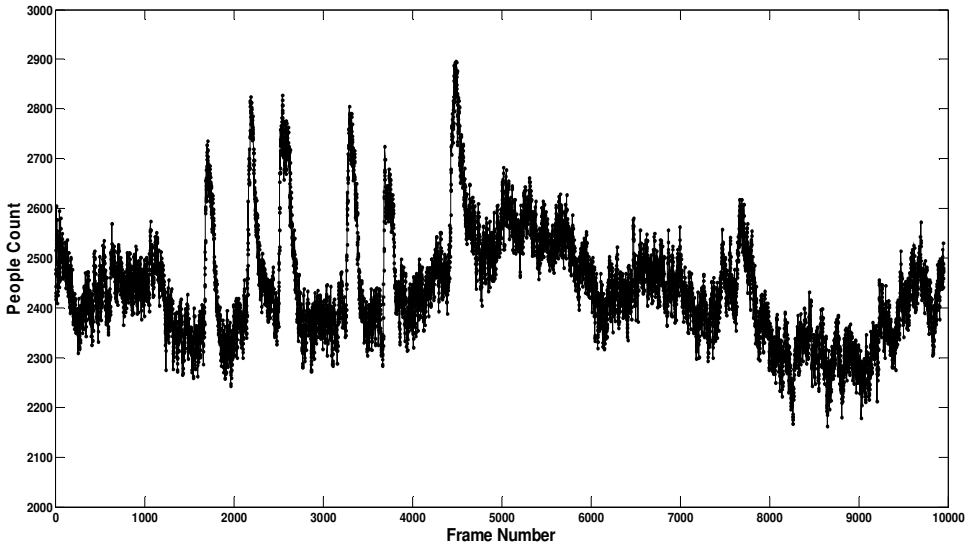


Figure 7: People count for all the frames in VD1

Similarly, in figure 6, average of counting error with standard deviation is plotted for the frame difference method. For the frame difference method, the optimal threshold value is found to be 15 at which the counting error has minimum value.

But comparing figure 5 and 6, it can be seen that approximate median is far better method as compared to the frame difference method in terms of counting accuracy. Hence we have selected approximate median method for the foreground segmentation with the threshold value equals to 50.

C. Performance analysis of the proposed framework

For the fixed setting of threshold value for foreground segmentation (equals to 50) and blob area of 23, people are counted in all the frames of VD1 (11,000 frames). To check the counting accuracy of the proposed framework, ground truth (actual number of people moving in the frame) is calculated for the frames after equal intervals. In figure 7, people count for 10,000 frames are plotted and it can be observed from the figure that people are coming and leaving the tawaf area. Total number of people remains between 2200 and 2900.

To check the accuracy of the counting of people, counting error is calculated and plotted in Figure 8 for 92 frames. Average counting error is found to be 3.5% with standard deviation of 3.1% which is very good in the scenario where the crowd is extremely dense, and people are moving at different speed in the video.

Similarly, number of people in video 2 is also plotted in Figure 9 for about 70 frames. The optimal blob area equals to 125 is used to count the people. The range of people count is between 20 and 640 approximately. Accuracy of the method is checked for eight frames selected at approximately equal time durations. The data is tabulated in Table 2 for the eight frames. Average people counting error is found to be 3.6%. It is assumed that same counting error will exist in the counting of all 70 frames.

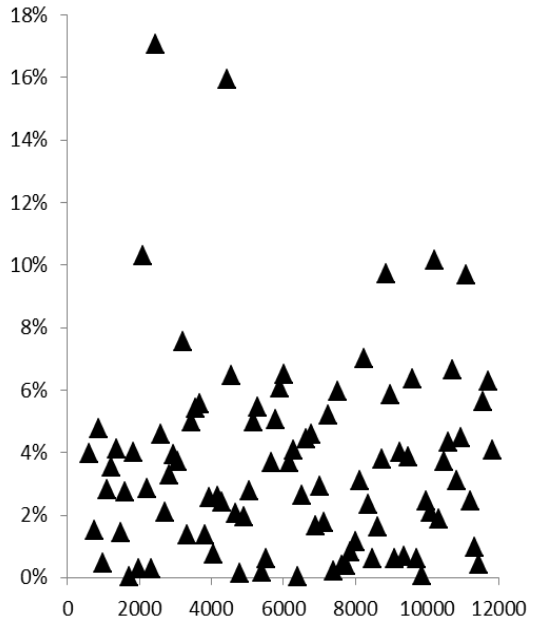


Figure 8: People count error (in percenatge) for selected frames in VD1. Overall Error is **3.5% ± 3.1%** (Error on y-axis and frame number on x-axis)

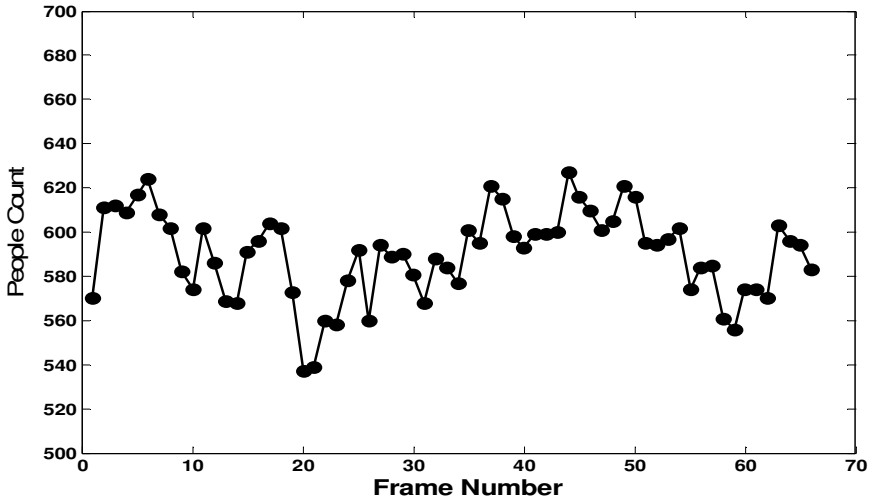


Figure 9: People count for VD2

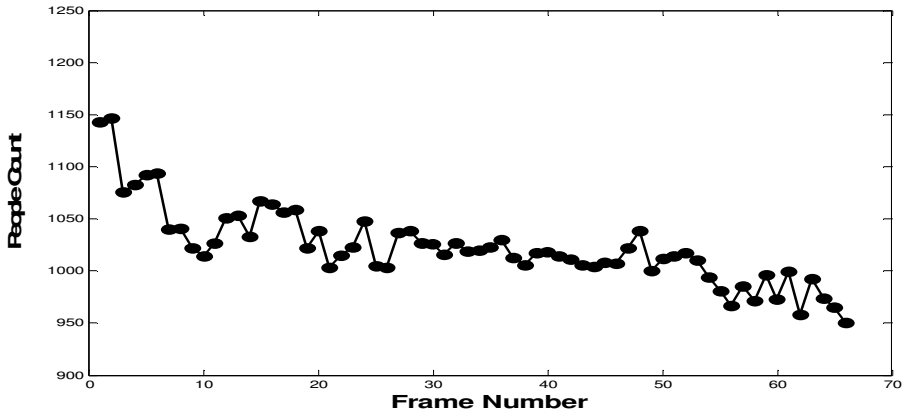


Figure 10: People count for VD3

Table 2: People Counting Error in VD2

Frame Number	Ground Truth	People Count	Error
15	595	617	3.69%
20	598	574	4.01%
30	592	537	9.29%
40	594	581	2.18%
45	595	601	1.00%
55	590	616	4.40%
60	589	616	4.58%
65	593	574	3.20%
75	595	594	0.16%
		Average Error	3.62%

In VD3, people are counted with the optimal blob area of 110 and threshold value of 50 for foreground segmentation. People count is plotted in Figure 10 for all 76 frames. It can be seen from the figure that number of people in the video is gradually decreased from 1150 to 950. Again accuracy of the method is checked for ten frames which are at almost equal duration of time and tabulated in Table 3. The average counting error is found to be 2.6% only.

A good accuracy of more than 96% is observed in all three videos which show the effectiveness of the proposed framework. It can be applied to the different focus settings of the camera just by optimizing the threshold and blob area values. In all three videos we have assumed that camera is watching the crowd from approximately top position and hence the effect of angled view is not significant.

Table 3: People Counting Error in VD3

Frame Number	Ground Truth	People Count	Error
18	1052	1041	1.04%
25	1031	1067	3.49%
30	1021	1038	1.66%
36	1021	1003	1.76%
42	1011	1027	1.58%
48	1014	1006	0.78%
55	977	1008	3.17%
60	1014	1012	0.19%
65	1020	981	3.82%
70	1030	973	5.53%
		Average Error	2.31%

In this paper we have considered extremely dense crowd and proposed a framework to count the people moving in the video in this crowd with different speed. A test case of Al-Haram mosque is considered in which hundreds of people are doing tawaf (circling around) of Kaaba. Threshold value is optimized for the foreground segmentation and timing analysis was done to find out its suitability for the online video processing. Blob area optimization is done for every video to find out the appropriate blob area for a particular setting of the camera. It is observed that proposed framework worked very well in counting the moving people in the extremely dense crowd with counting accuracy of more than 96% in all three videos. This validates the efficacy of the proposed framework in counting the extremely dense crowd.

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Investigation of Physical Characteristics of Bread by Processing Digital Images (machine vision)

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Abstract: In the current research, application of image processing in colorimetry of medium-sized soya-enriched bread crust is discussed. For this purpose, loaves of bread enriched with soy flour at 4 levels (0, 4, 8 and 12%) were produced. Image processing for extraction of color parameters from 96 pictures was carried out in L*a*b COLORSPACE and color space transformation was conducted in a two-stage procedure with Image J software. Statistical analysis showed that enrichment of bread with different levels of soy flour will lead to a significant effect on mean values of L, a, and b components, and standard deviation of L and b.
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Key Words: Soya flour (soybean flour or soy flour), Colorimetry, Image Processing

1. Introduction

Among physical characteristics of foods, color is known as the most important apparent feature in perception of quality. The customers tend to correlate color to flavor, safety, durability, and nutritional properties. Satisfaction level is influenced by color thanks to strong correlation with physical, chemical, and sensory assessment of food qualities [4]. Color is the most significant property of image because of embracing main information of pictures, similar to human's vision. In fact, all the contents of image are color components stored in image pixels. As such, each color can be reconstructed by combining the three main colors. Colorimetric information of images can be extracted through emplacing pictures in different colorimetric conditions and calculation of mean value and standard deviation of color intensity in image pixels [5]. Vision machine is the technology of preparation and analysis of images of a real scene using computer in order to acquire information or control a process. Vision machine is a non-destructive and scientific technique for evaluation of color pattern in non-uniform colorimetric levels. Food industry is the evident instance of image analysis application; the major elements include visual evaluations and description of foods in images whose properties can be extracted and expressed as quality index (5). Conventional methods of sensory assessment are widely used in determining quality of foods. But, such methods are time-consuming and costly. These factors lead to motivation for developing alternative techniques which can evaluate key characteristics of products in shorter time and higher precision. It was proved that application of image processing in assessment of qualitative characteristics is one of the most promising areas of research [3]. Color is an effective parameter for evaluation of objects in images of different foods including variety of fruit, vegetable, cereals, and meat. This parameter is used for grading variety of fruits. More ever, researchers have deployed diverse methods for evaluating maturation degree of tomato. Colorimetric evaluation is applied in meat industry for automatic analysis and grading of meat treatment and improving objectivity of process. Color images have been used for analyzing defects and diseases of birds' meats [1].

In a paper, SUN et al. [2006] investigated the recent studies for qualitative evaluation and inspection of food products using image analysis techniques. They analyzed four aspects of image processing application in qualitative assessment including color, size, shape, and texture [5]. Pedreschi et al. (2006) have used image analysis in L*a*b model for evaluating chips color. In his research, he transformed the images obtained in RGB model to L*a*b color space using a program of MATLAB software with artificial neural network (4).

Briones et al. (2004) used image processing for tracking color variations of milk chocolate crust during preservation period. Milk chocolates were placed under intensified conditions for fat migration and evaluated in different time intervals. These researchers first converted captured RGB images to CIE XYZ model and then into CIE L*a*b model using MATLAB software. They also studied the correlation between colorimetric values acquired from image processing with values measured by HUNTERLAB

machine [2]. In his paper, TAN (2003) collected results of researches conducted during the recent years on using image processing in meat quality assessment and prediction of its qualitative degree [7]. YUM et al. (2003) introduced novel method of image processing based on imaging with digital camera by means of PHOTOSHOP software. They utilized this software for determining L*a*b values and colorimetric distribution of images [9]. SUN et al. (2002) reviewed the research works in the field of assessment and grading of agricultural and alimental products using image processing [6]. TAN et al. (2000), employed color-based image processing for grading pieces of muscle meats. Mean and variance of colorimetric values are evaluated using two models, namely RGB and HIS in the current research. Artificial neural network modeling and statistical methods for final values will be used for prediction and evaluation.

2. Materials and Methods

2.1. Bread Baking

Soya flour was bought from local stores in URMIA city. Flour, salt, liquid oil, yeast dough, sugar, and supplementary additives were the raw materials for baking the medium-sized bread. Bread baking procedures were as follows: after mixing the raw materials of formula and making dough for 20 minutes in low-speed rotation of the special instrument, the dough was relaxed for two minutes, and then, kneaded for one minute at low speed. The resulting dough was again relaxed for 10 minutes. The dough was relaxed for another 10 minutes after dividing the product into round shapes. This step was followed by shaping the dough and transferring the trays into proof. The trays were placed under 24 C water steam in the proof. The dough was baked in oven at initial and secondary temperatures of 250 C 300 C in presence of water steam for 9 minutes. The medium-sized bread was made in four soya levels (zero, four, eight, and twelve percents of soya which replace the wheat flour in the formula). The tests were carried out 12 and 36 hours after the bread baking. These tests were replicated three times.

1- Image Capturing

In each baking series, 4 breads were randomly selected and 12*25 cm pieces were separated and imaged. To avoid light reflection in the space and preventing from fluctuation in imaging, a chamber having walls covered with black fabric was used for imaging. The images were captured by a Canon camera model Powershot A520 which was connected to computer via USB port. The camera was fixed parallel to and at a distance of 20 cm from samples. Imaging was performed using ZoomBrowser EX 5.0. Other camera specifications are expressed for imaging in table 1. Images were taken in M mode of camera. In this mode, it is possible to adjust shutter speed and Iso-Velocity and AV Aperture. Images were captured from selected pieces of bread samples in 2272*1704 pixel dimensions and resolution of 180 dpi.

2- Color Spaces

3-1- RGB color space

RGB color space is composed of three colorimetric components namely, Red, Green, and Blue, each of which varies in the range 0-255. Every pixel in RGB images has certain values of red, green, and blue components.

3-2- L*a*b Color Space

This color space consists of three L* components equivalent for image light which vary in the range 0 (representing black) and 100 (representing complete light reflection). Values of a* is unlimited and the positive and negative values respectively green color. "b*" value is also infinite where positive and negative values are equivalent for yellow and blue colors. This colorimetric system has a performance similar to human's eye. This space is not affected by imaging unlike RGB and HIS spaces. In most cases, L*a*b colorimetric space is sued in research studies of food industries [10].

3- Image Processing

1000*1000 pixel pieces are cut from the captured images and saved under BMP format. The images were converted into CIE XYZ and then into L*a*b spaces using ImageJ1.40g software and by means of the ImageJ package referred to as "Color_Space_Converter".

According to the proposed code, two-stage method was applied for converting the information acquired from pixels in RGB into L*a*b color space. In the first stage, RGB parameters were converted into XYZ space in [0 1] domain:

$$[X \quad Y \quad Z] = [r \; g \; b]M$$

Where:

$$r = \left(\frac{R + \alpha_1}{\alpha_2}\right)^{\gamma}$$

$$g = \left(\frac{G + \alpha_1}{\alpha_2}\right)^{\gamma}$$

$$b = \left(\frac{B + \alpha_1}{\alpha_2}\right)^{\gamma}$$

Where, γ is modifying (fitting) parameter equal to 2.2 and M was transform matrix of two spaces

determined according to reference point. In this equation, D65 is taken as reference point and M includes:

$$M = \begin{bmatrix} 0.5767 & 0.2973 & 0.0270 \\ 0.1855 & 0.6273 & 0.0706 \\ 0.1882 & 0.0752 & 0.9912 \end{bmatrix}$$

In the second stage, transform was performed from XYZ into L*a*b spaces, where:

$$l = 116 f_y - 16$$
$$a = 500(f_x - f_y)$$
$$b = 200(f_y - f_z)$$

And also:

$$f_x = \begin{cases} \sqrt[3]{x_r} & x_r \rangle \varepsilon \\ \dfrac{kx_r + 16}{116} & x_r \langle \varepsilon \end{cases}$$

$$f_y = \begin{cases} \sqrt[3]{y_r} & y_r \rangle \varepsilon \\ \dfrac{ky_r + 16}{116} & y_r \langle \varepsilon \end{cases}$$

$$f_z = \begin{cases} \sqrt[3]{z_r} & z_r \rangle \varepsilon \\ \dfrac{kz_r + 16}{116} & z_r \langle \varepsilon \end{cases}$$

$$x_r = \frac{X}{X_r}\ ,\ y_r = \frac{Y}{Y_r},\ z_r = \frac{Z}{Z_r}$$

Where, (X_r, Y_r, Z_r) represents reference white.

$$\varepsilon = \begin{cases} 0.008856 & \textit{Actual} \text{ CIE Standard} \\ 216/24389 & \text{Intent of the CIE Standard} \end{cases}$$

$$k = \begin{cases} 903.3 & \textit{Actual} \text{ CIE Standard} \\ 24389/27 & \text{Intent of the CIE Standard} \end{cases}$$

"k" and "ε" are constants recommended by CIE standard.

Following evaluation of colorimetric parameters in L*a*b space, mean and standard deviation values of each parameter were determined using the following equations:

$$m_L = \frac{\sum\sum L(i,j)}{n},\ m_a = \frac{\sum\sum a(i,j)}{n},\ m_b = \frac{\sum\sum b(i,j)}{n}$$

$$v_L = \frac{\sum\sum [L(i,j)-m]^2}{n-1},\ v_a = \frac{\sum\sum [a(i,j)-m]^2}{n-1},\ v_b = \frac{\sum\sum [b(i,j)-m]^2}{n-1}$$

Where (i, j) and "n" respective denote coordinates and number of pixels in each image [1]. Figure 3 demonstrates the converted image.

4- Statistical Analysis

Completely random plan in factorial block was used for statistical analysis of results. Mean values were compared using Duncan's multi-domain test. Statistical analysis was performed in MstatC software.

Results and Discussion

Results of variance analysis as presented in table 2 indicate the effect of adding Soya flour to formulation of medium bread is significant on L, "a", and "b" colorimetric parameters and also on standard deviation of L and "a" colorimetric parameters in 99% confidence interval. Furthermore, mutual effect of Soya flour and preservation time is proved also to be significant on standard deviation of L and "a" colorimetric parameters ($p<0.01$), as shown in table 2.

Results of comparison of mean values included in diagrams 1 to 6 show that enrichment of medium-sized bread with soya flour considerably affects crust color of product so that average values of L, "a", and "b" decrease as soya flour percentage increases. Additionally, adding soya flour to bread formulation leads to reduction of variance of colorimetric parameters, and in other words, further uniformity in pixel features of images. Therefore, it can be inferred that application of image processing is a quantitative, precise but simple, and non-destructive method for colorimetric evaluation of bread crust. Due to necessity of bread production (baking) in industrial units, application of this technique enables online automation of production and quality assessment of bread color.

Diagrams, Figures, and Tables

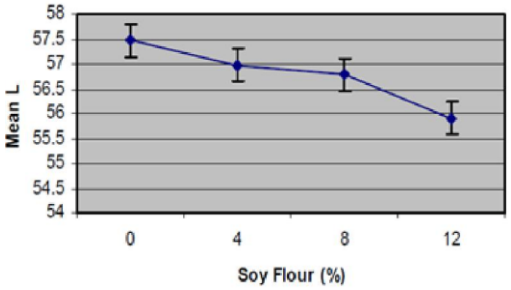

Diagram 1 – Variations of mean value of the color parameter L*

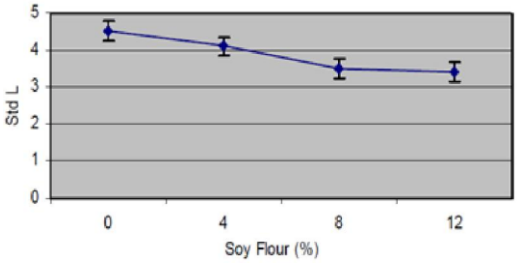

Diagram 2 – Variations of standard deviation of the color parameter L*

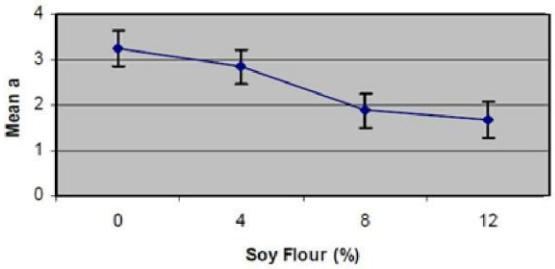

Diagram 3 – Variations of mean value of the color parameter a*

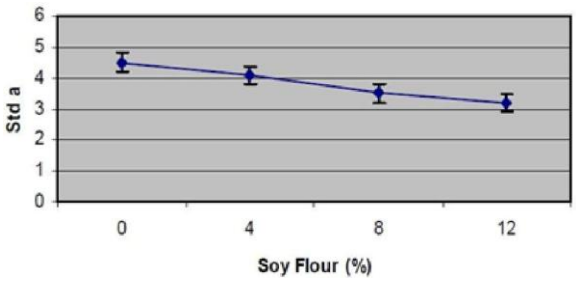

Diagram 4 – Variations of standard deviation of the color parameter a*

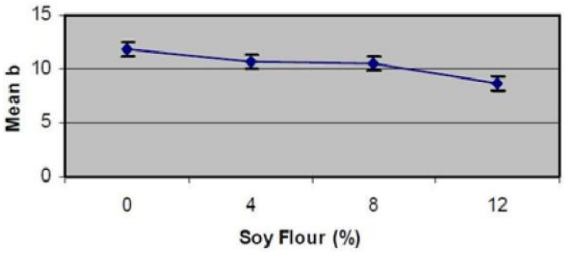

Diagram 5 – Variations of mean value of the color parameter b*

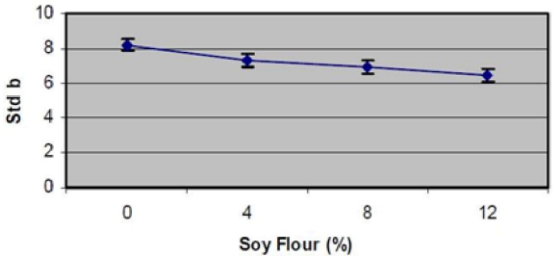

Diagram 6 – Variations of standard deviation of the color parameter b*

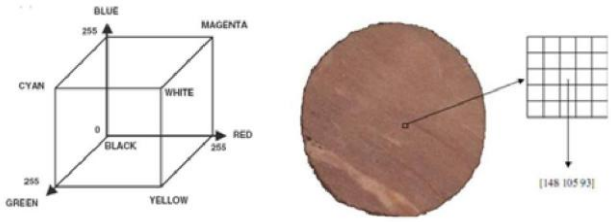

Figure 1- A sample of captured images

Figure 2- Schematic representation of EGB color space

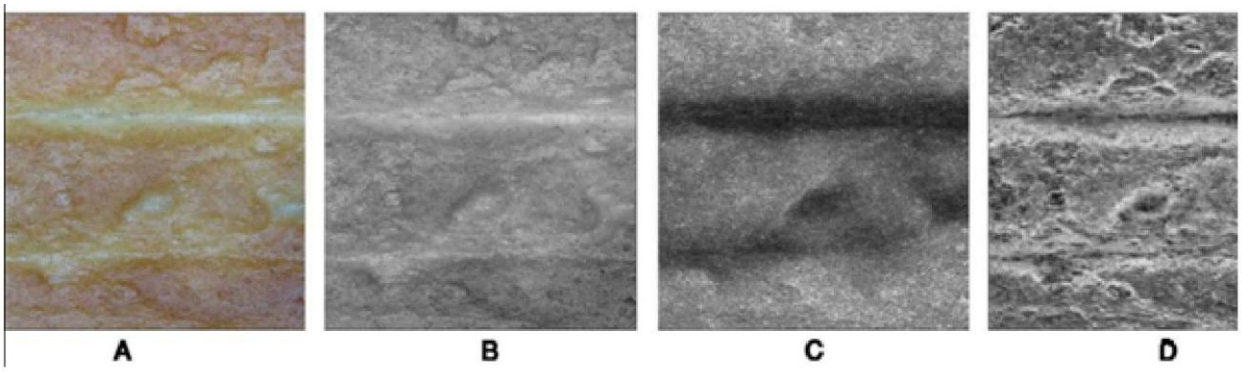

Figure 3- Example of converted image; A: sample of cut photoB: L* component of image C: a* component of image D: b* component of image

Table 1: Camera Settings for Imaging

Flash	Off
Zoom	On
ISO velocity	100
White balance	Fluorescence H
Aperture AV	F/2.6
Macro	On
Shutter speed	1/10 s

Table 2- Variance analysis of impact of operational parameters on colorimetric parameters in L*a*b space

		Mean Squa res					
Source	Degree of Freedom	ML	Mb	Ma	Std L	Std a	Std b
Soy flour percentage	3	10.344	42.12	40.77	13.47	5.89	10.96
Preservation Time	1	0.022	0.303	0.335	1.125	0.132	1.021
Soya flour* preservation time	3	3.171	4.856	1.867	1.460	0.845	10.27

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Antimicrobial susceptibility of *Escherichia coli* isolated from patients with urinary tract infection referred to Imam Ali Hospital Kermanshah, Iran (2011)

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Abstract: Background: A urinary tract infection (UTI) is an infection anywhere in the urinary tract. *Escherichia coli* (*E.coli)* is the most common cause of urinary tract. The aim of this study was carried out to determine the antibiotics susceptibility of *E.coli* isolated from patients with UTI referred to Imam Ali Hospital Kermanshah, Iran (2011). **Materials and Methods:** This descriptive study was performed on 1031 isolates of *E.coli* isolated from patients with UTI in Imam Ali Hospital Kermanshah, Iran (2011). The urine cultures were performed by the streak plates method with blood agar medium and Eosin-Methylene Blue (EMB). The bacterial identification procedures with conventional biochemical tests were performed according to National Committee for Clinical Laboratory Standards (NCCLS) standard tests. Antibiotic susceptibility testing was performed by disk diffusion method. **Results:** Based on the result of antimicrobial testing susceptibility to Ciprofloxacin, Nitrofurantoin, Ceftizoxim, Ceftriaxon, and Ceftazidim were 99%, 83%, 74%, 70%, 66% respectively. Also susceptibility for Amikacin, Gentamycin, Ampicillin, Amoxicillin, Cephalexin, Cephalothin, Nalidixic acid, Co-trimoxazole, and Co-amoxyclave were under 50%. **Discussions:** Antimicrobial resistance pattern is different in each area and it is permanently changing. Ciprofloxacin, Nitrofurantoin, Ceftizoxim, Ceftriaxon, and Ceftazidim are suitable antibiotics for treatment, also Ampicillin and Co-amoxyclave are ineffective on *E. coli*.
[Reza Faraji, Fereidoun Sabzi. **Antimicrobial susceptibility of *Escherichia coli* isolated from patients with urinary tract infection referred to Imam Ali Hospital Kermanshah, Iran (2011).** *Life Sci J* 2012;9(3):1679-1682] (ISSN:1097-8135). http://www.lifesciencesite.com. 244

Key words: *E. coli*, Urinary tract infection, Kermanshah

Introduction

Urinary tract infections (UTIs) are a group of infections of the urinary tract. It is the second most common infection in human and a major cause of morbidity and mortality. In the United States, UTIs account for nearly seven million office visits, a million emergency department visits, and one hundred thousand hospitalizations every year (1). The incidence of UTI is in adult women and men of all ages but it occur more commonly in women than men (because, in females, the urethra is much shorter and closer to the anus), so that up to 40% of women will develop UTI at least once during their lives, and a significant number of these women will have recurrent urinary tract infections. Conversely, in males and children, UTI generally reveals a urinary tract lesion that must be identified by imaging and must be treated to suppress the cause of infection and prevent recurrence (2, 3). Most of UTIs (80–85%) are due to *E.coli. It* is a member of the *Enterobacteriaceae* family and normal flora of the gut. *E.coli* is pathogenic bacterium commonly found in various contaminated sources and poses a major health risk (4). According to the importance of this infection, suitable treatment should be done. Treatment is done with antibiotic, but nowadays due to the self-treatment and also widespread use of antibiotic by patients and prescription of antibiotic without any test to determine the antimicrobial resistance by the physician, it causes the resistance of this infection toward the existing antibiotics and that's why the resistance of antimicrobial becomes an important problem in all over the world, nowadays. So identifying efficient and suitable antibiotic is of great clinical importance (5, 6, and 7). The aim of this study is determining the antibiotics susceptibility of *E. coli* isolated from patients with urinary tract infection referred to Imam Ali Hospital Kermanshah, Iran (2011).

Materials and Methods

This descriptive study was performed on 1825 urine samples patients referred to Imam Ali Hospital Kermanshah, Iran (2011), during 24 months, from January until December 2011.

urine samples were collected in a state of clean catch midstream urine, and stored in laboratory Hospital under refrigeration at 4ºC until they were used in experiments.

The urine cultures were immediately performed by the streak plate's method with blood agar medium and EMB. The bacterial growth was assessed after 24–48 h of incubation when indicated. The bacterial identification procedures with conventional biochemical tests (such as: VP and MR, KIA, TSI, SIM, and H_2S) were performed according

to National Committee for Clinical Laboratory Standards (NCCLS) standard tests. The urine culture was considered positive when there was growth of any number of colonies (The growth of more than 10^5 CFU/ml colonies was considered to be positive sample). The susceptibility test to antimicrobials was performed using the disk diffusion method, modified from the Kirby-Bauer method. The reading zone sizes were determined according to the standards provided by the NCCLS.(8,9)

The antibioctic used for the tests included: Ciprofloxacin (30 mcg), Nitrofurantoin (30 mcg), Ceftizoxim (30 mcg), Ceftriaxon (30 mcg), Ceftazidim (30 mcg), Amikacin (30 mcg), Gentamycin (10 mcg), Ampicillin (10 mcg), Amoxicillin (20 mcg), Cephalexin (30 mcg), Cephalothin (30 mcg), Nalidixic acid (30 mcg), Co-trimoxazole (10 mcg), and Co-amoxyclave (30 mcg).

Results

1825 urine samples patients referred to Imam Ali Hospital Kermanshah, Iran (2011) were eligible for this study. Of the 1825 urine samples 1216 of the urine cultures were positive. And of 1216 positive cultures, 1031 cases (85%) were *E.coli*. that, 247 cases (24%) were males and 784 cases (76%) were females. Also 185 cases (15%) were other organism (such as: *Klebsiella sp, Enterococcus*, *Staphylococcus epidermidis, Proteus* sp, and *Enterobacter*, respectively) (Figure 1).

The highest sensitivity rate was for Ciprofloxacin (99%), Nitrofurantoin (83%), Ceftizoxim (74%), Ceftriaxon (70%), and Ceftazidim (66%), respectively. And susceptibility for other antibiotics was under 50%. Also the highest resistance rate was for Ampicillin (90%), Co-amoxyclave (81%), Gentamycin (77%), Amikacin (70%), and Amoxicillin (70%), respectively (Table 1).

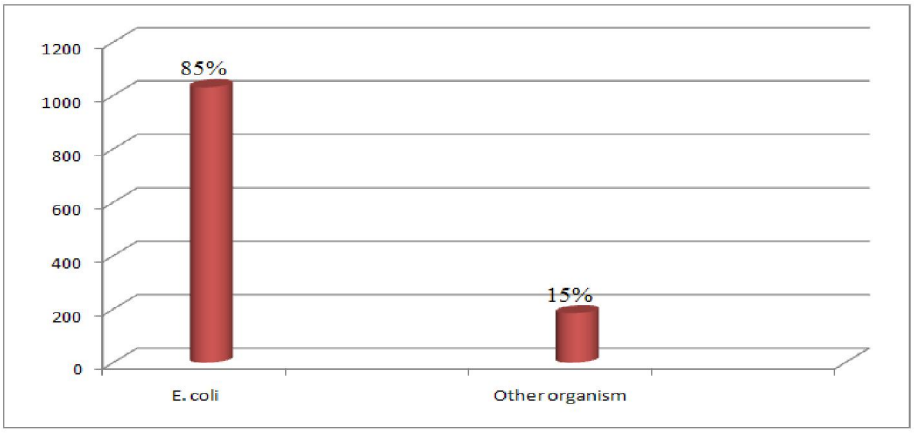

Figure 1. The prevalence rate of *E. coli* in patients with urinary tract infection referred to Imam Ali Hospital Kermanshah, Iran (2011)

Table 1. Antibiogram pattern of *E.coli* isolated from urine culture in Imam Ali Hospital Kermanshah, Iran (2011)

Antibiotic	Antibiogram result			
	Sensitive	Intermediate	Resistance	Total
Amikacin	27 (7%)	98 (23%)	296 (70%)	421 (100%)
Gentamycin	48 (11%)	53 (12%)	325 (77%)	426 (100%)
Ampicillin	7 (1%)	48 (9%)	478 (90%)	533 (100%)
Amoxicillin	15 (11%)	27 (5%)	99 (70%)	141 (100%)
Cephalexin	33 (29%)	18 (15%)	64 (56%)	115 (100%)
Cephalothin	23 (23%)	19 (19%)	59 (58%)	101 (100%)
Ceftazidim	307 (66%)	104 (22%)	58 (12%)	469 (100%)
Ceftizoxim	397 (74%)	88 (17%)	48 (9%)	533 (100%)
Ceftriaxon	380 (70%)	79 (15%)	79 (15%)	538 (100%)
Ciprofloxacin	795 (99%)	1 (1%)	-	796 (100%)
Nitrofurantoin	586 (83%)	33 (5%)	88 (12%)	707 (100%)
Nalidixic acid	119 (21%)	201 (36%)	237 (43%)	557 (100%)
Co-trimoxazole	245 (33%)	98 (13%)	398 (54%)	741 (100%)
Co-amoxyclave	3 (3%)	17 (16%)	84 (81%)	104 (100%)

Discussions

UTI due to *E.coli* is highly prevalent. Recently the number of reports upon the resistance to antibiotic discs is rising. Thus the choice of an effective and apporopriate drug after diagnosis becomes of utmost importance. The routine method to measure antibiotic sensitivity in bacteria is based on two principles: dilution and diffusion. The disk diffusion sgar method is a method based on diffusion alone and can determine the sensitivity or resistance of the bacteria to a specific antibiotic (10,7). In this study, prevalence rate of *E.Coli* based on the disk diffusion method was 85%. In the different performed studies in Iran, Saudi Arabia, North and South America, Europe and the United Kingdom , *E.Coli* have been introduced as the most common cause of UTI and can be due to the high presence of this bacteria in the gut and its adhesion to urethra epithelial cells (11,12,13,14,15). In this study women were infected more than men. In a study which was done by Cetin in the south of Turkey, prevalence rate of infection in women was more than men (16). Also, Farajnia in his own study which was done in several cities in north of Iran, has reported that prevalence rate of *E.Coli* was more in women (11). Casuse of this infection in women can be considered by reason of short perineum and closeness of its mouth to the anus .While, the prostatic secretions containing the bactericide substances and Zn, plays a great role in countering with *E.Coli* and causes the prevention of this kind of infection in men (17). Difference of sensitivity rate was significant among the various types of antibiotics used in this study. In this study, maximum rate of sensitivity was observed in *E.Coli* strains to Ciprofloxacin (99%). Like our study, *E.Coli* showed sensitivity to Ciprofloxacin (100%) in the study of Grude which was done in Norway (18). Farrell found Ciprofloxacin as the most effective antibiotic against *E.Coli* in his own study too (19). In this study, Nitrofurantoin with 83% has the highest sensitivity after Ciprofloxacin. Also Like our study, Grude introduced Nitrofurantoin with 97% as the most sensitive antibiotics after Ciprofloxacin (18). The high sensitivity of Ciprofloxacin and Nitrofurantoin is due to the limited use of antibiotics by physicians in the medical system. In this study, third-generation Cephalosporins were stood in third place, based on Antimicrobial sensitivity, after Ciprofloxacin and Nitrofurantoin. So that the sensitivity to Ceftizoxim, Ceftriaxon and Ceftazidim were 74%, 70% and 66% respectively.

Matute was estimated the sensitivity to Ceftriaxon in his study which was more than 90% (20). Fluit reported that the most sensitivity are belong to Ceftizoxim and Ceftazidim (more than 70%), based on massive studies on 25 I.C.U in Europe (21). In spite of influence of third-generation Cephalosporins on UTI of *E. coli*, but, it seems that there's not considerable resistance to these antibiotics. Same as other studies (22, 23), other antibiotics used in this study showed the sensitivity below 50%. So that, Amikacin 7%, Gentamycin 11%, Ampicillin 1%, Amoxicillin 11%, Cephalexin 29%, Cephalothin 23%, Co-trimoxazole 23%, Nalidixic acid 21% and Co-amoxyclave 3% showed sensitivity. These results showed widespread use of these antibiotics and it's followed by creation of high resistance in isolated E. *coli*. So that, Ampicillin and Co-amoxyclave with 90% and 81% of resistance, was known as ineffective antibiotics against E. *coli*.

Conclusion

According to various studies, as well as results obtained by specialist researchers about this issue all over the world, it can be concluded that according to the continuous changes in causing factors of UTI (which this factor would cause some changes in sensitivity or resistance in bacteria to the antibiotics), and also based on different impacts of each special condition on various regions (which would cause some changes in sensitivity or resistance in bacteria to the antibiotics), it's recommended that for appropriate treatment and prevention of bacterial resistance, before prescribing antibiotics, certainly by antibiogram test, would be sure that antibiotics have positive effects on related infections.

Acknowledgments

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Effect of Plant Growth Inducers on Morpho-physiological Traits of Corn (*Zea mays* L)

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Abstract: In order to study solvent-dispersing effect of inducing plant growth matters on morpho-physiological traits of double-cross 704 corn, an experiment was conducted under field conditions in complete randomized split blocks plan with 8 replications and 6 treatment of inducing plant growth matters: MARMARIN, HB_101, EXIN (INDOLE acetic acid), CYCOCEL, ETHEPHON, and control case. ANOVA results showed that the traits of stem diameter and height, length and number of panicle twigs, biological yield, and harvest index were significant at least in probability value of 5 percents. MARMARIN and HB_101treatments led to increase in stem length and diameter, biological yield and harvest index, and also, to reduction in number of panicle twigs. EXIN caused increase in stem length, length of panicle, biological yield and harvest index besides reduction of stem diameter and number of panicle twigs. Yet, level of yield increase was lower than the two previous treatments. CYCLOCEL and ETHEPHON resulted in enhancement of stem diameter as well as number of panicle twigs. ETHEPHON reduced biological yield as well as the stem length but did not exhibit a statistically significant difference for harvest index compared to the control treatment.

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Key Words: Cycocel, Marmarin, HB_101, Exin, Ethephon and Corn

Introduction:

Application of plant growth inducers in association with cereals growth treatment dates back to four decades ago [MOJTAHEDI & LESANI, 2005]. Role of growth regulators in global agriculture is low compared to other chemicals used in farming such as fungicides, pesticides and insecticides, and, global sales of plant growth regulators barely account for 4% of total turnover of different protective substances [PERAKASH & RACHAMANDRAN, 2000]. Application of regulating substances is occasionally intended to reach potential yield in crops and also to have the possibility of applying high planting densities as well as higher amounts of nitrogen fertilizers [PITULA et al, 1999]. Evident increase of energy cost, perpetual decline of fertile lands due to being transformed into urban and industrial areas, and the certain need to double food production in the world in near future all will guarantee exceeding role of growth regulators [MOJABI, 1994]. Change in plant height of corn results from variations of inter-nodal length not the number of internodes [KUCHEKI & SARMODNIA, 1998]. CYCOCEL application leads to development of shorter and thicker stems [MATOUS & MALDICUS, 1981] and also improvement of grain yield in wheat thanks to increased number of grains per unit area [SHEKUFA & EMAM, 2005]. Thickening of cellular wall and enhancement number of vascular successions are among the most significant anatomical effects of CYCOCEL on wheat [PITULA et al, 1999]. Future outline of corn cultivation is yield improvement in genotypes whose grain filling stage durations are long [KUCHEKI & BANAYAN, 1994]. ETHEPHON is a compound which remarkably influences plant growth through releasing ethylene and reduces longitudinal stem growth [Davis, 1988]. It is the simplest recognized OLPHIN with molecular weight of 28 Daltons weighing lighter than air under physiological conditions, [KAFI et al, 2000] and its application in wheat contributes to significant reduction of plant height and improvement of grain yield [Foster & FARIS, 1992]. EXIN is a term for plant growth substances that somehow stimulates the cellular lengthening. INDOLE acetic acid is the first extracted and identified growth inducing substance [KUCHEKI & BANAYAN, 1994]. MARMARIN is a natural growth inducer extracted from the seaweed SCHOPHYLUM NOSOSIUM and contains over 70 kinds of nutrients, enzymes, organic acids and plant

growth inducers. Today, algae are widely exploited in industrial, agricultural, pharmacological and nutritional fields and modern technology is deployed for extraction and exploitation of algae in the advanced and industrial countries [SOHRABIPOUR et al, 2003]. Increase in growth inducers resulting from algae contributed to enhanced protein amount in pasture grasses and affected the amount of meat of livestock feeding on these pastures [Davis, 1981]. Weight of banana bunches increased 14 to 18 % by applying algae growth inducer and considerable enhancement was observed for corn as well [BLONDEN, 1972]. HB_101 is the trademark of a kind of growth inducer derived from decomposition and extraction of substances found in plants such as cedrus, pine, banana, plantago major and similar trees which feature long life and high stability; this inducer intensifies the mobility of substances in plants. Probably, the harmonic factors associated with dryness, light deficiency in dense plant areas or nitrogen deficiency cause growth stoppage and demise of ova fertilized in the tip [KUCHEKI & BANAYAN, 1994]. HB_101 consumption might be effective in yield improvement taking into account that nutrient absorption rate in corn declines after flowering [FAT-HI, 1999] and mobility of stem-accumulated matters –which comprise the excess products related to photosynthesis prior to grain filling stage- has a large contribution in grain yield [EVISTON et al, 1980; GALANGER et al. 1976]. Additionally, the amount of nutrients absorbed by a plant does not by itself determine total biomass or yield but consumption stage of nutrients is the determining factor, which unlike the absorption stage depends on internal properties of plant [EMAM & NIKNEZHAD, 1994]. Due to significance of corn production among cereals [fodders and grain], the yield might be directly or indirectly improved by impact of synthetic plant growth inducers and natural growth inducers. For this purpose, the current research analyzed the impacts of synthetic growth inducers (EXIN, CYCOCEL and ETHEPHON) and natural growth inducers made up of plants (MARMARIN and HB-101) together with control treatment on morpho-physiological traits and yield of corn.

Materials and Methods

In the current experiment, treatments included the grain corn (double-cross 704) affected by five growth inducers namely INDOLE acetic acid, CYCOCEL, HB_101, MARAMARIN and control case (no application of growth inducer).

Experiment Procedures: The experiment was carried out with 6 treatments and 8 replications using complete randomized split blocks plan in Agricultural Research Station, Uremia, Iran during the farming year 2008.

Farming Operation: The test field was initially in fallowed state. It was deeply ploughed by moldboard ploughs in early April 2008, and following surface rotavator, ridges and tillages were created in four corners of farm which was then split into plots. 48 plots were made, each 3*4 m2. After land preparation, insides the plots were superficially ploughed and then flattened by spade. The seeds were planted in the plots in four rows in 60-cm * 22-cm distances along each row and between two successive rows, respectively. The planting density and depth were respectively 75,000 plants per hectare and 5-7cm. To have reliable germination and complete number of plants in each plot, three seeds were planted in each hole; upon greening and alleviation of AGROTIS risk, two plants were eliminated from each hole and one plant remained intact. The fertilizers were consumed according to soil analysis results. 360 kg per hectare of urea compost was used in three stages (one third before planting, one third in 3-4 leaf stage, and one third in tasseling stage). Also, 100 kg of diammonium phosphate per hectare and 200 kilograms of sulfate potassium per hectare were uniformly applied in all treatments. Weeds were regularly eliminated during growth season, and to prevent dryness stress in plant, irrigation was regularly and meticulously implemented every 7-10 days throughout the vegetative period. According to experiment plan, treatment of inducers was applied as solution over the leaves twice: one week before and one week after the pollination. The traits under study were measured and recorded following application of treatments until harvesting the crops. Concentration of plant growth inducing and regulating substances were adjusted under farm conditions as below:

INDOLE acid a acetic: 20 ppm, CYCOCLE: 100 ppm, ETHEPHON: 33 ppm, MARMARIN: 1.5 liter per 1000 liters of water, and HB_101: 100 cc in 1000 liters of water (in accordance with instructions of manufacturing factory and their consumption levels in agricultural products and cereals). Variance analysis (ANOVA test) was performed on the obtained data using MSTAT_C software and the mean values were compared by means of LSD test in probability value of 5 percents.

Results and Discussions

Variance analysis (ANOVA) results implied that application of plant growth inducers affected the morpho-physiological traits in corn. The effect was significant at least in p-value of 5% on the following traits: stem diameter and height, number and length of panicle twigs, biological yield, and harvest index (Table 1).

Stem Length and Diameter

The traits of stem height and diameter exhibited very significant contrast under growth inducers treatment ($p<1\%$); the maximal increase of stem diameter and height respectively belonged to EXIN and MARMARIN treatments and the maximal reduction of stem length was observed in ETHEPHON treatment while EXIN had the lowest impact on stem diameter (Figures 1 and 2).

Table 1: Analysis of randomized complete blocks experiment under field conditions

		Mean of squares							
S.O.V	d.f	stem length	stem diameter	number of leaves per plant	number of leaves above the corn	length of panicle	number of panicle twigs	biological yield	harvest index
Replication (R)	7	91/94 ns	0/036 ns	0/432 ns	0/395 ns	1/457 ns	1/329 ns	66548/64 ns	25/482 ns
Treatment (T)	5	1995/933 **	1/047 **	0/84 ns	0/117 ns	6/534 *	89/659 **	3055790/471 **	474/277 **
Error	35	66/076	0/026	0/474	0/124	1/985	0/791	217062/918	12/885
Coefficient of Variations (%C.V)		3/18	7/73	5/94	6/32	3/1	8/06	11/4	13/9

ns, * and ** : Not significant, significant at 5% and 1% probability levels of probability, respectively.

INDOLE acid acetic led to increased longitudinal growth of stem cells and expansion of cellular wall [KAFI et al, 2000]. ETHEPHON has been used in a large group of plants and the results demonstrate that this substance reduces the longitudinal growth of stem [Davis, 1988]. ETHEPHON application in wheat resulted in significant reduction of plant height and improvement of grain yield [Foster & FARIS, 1992]. CYCOCEL administration leads to development of shorter and thicker stems through compaction of cellular cytoplasm and the height of the treated plant is reduced [MATOUS & MALDICUS, 1981]. Presence of harmonic compounds in algae composts contributes to enhanced growth and development of grass proteins in pastures up to 7 percents [SOHRABIPOUR et al, 2003]. Mobilization of stem-accumulated matters –which comprise the excess products related to photosynthesis prior to grain filling stage-, was to some extent helpful in improvement of grain yield. This phenomenon is further noticeable in grain filling stage particularly in the event of stresses such as dryness and high temperature [EVESTIN et al, 1980; GALANGER et al, 1976]. According to the analysis performed, corn plant height variations is not caused by changes in number of stem nodes but increase or decrease of stem length in cereals including corn is mainly due to change of inter-nodal size. And, variations of corn plant height also originate from changes of inter-node length not their number [KUCHEKI & SARMODNIA, 1998].

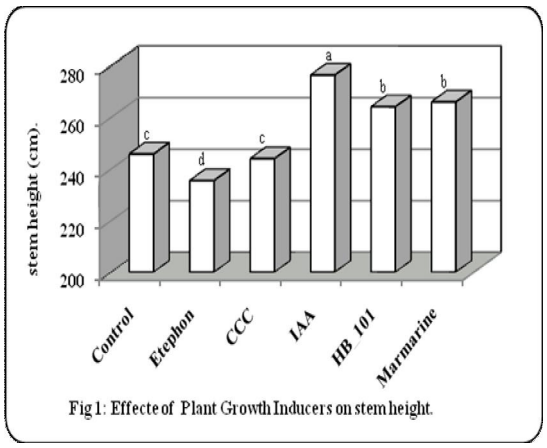

Fig 1: Effecte of Plant Growth Inducers on stem height.

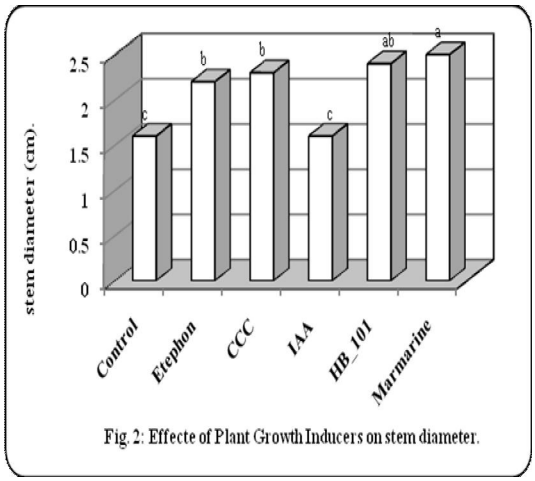

Fig. 2: Effecte of Plant Growth Inducers on stem diameter.

Number of leaves per plant and number of leaves above the corn

Number of leaves per plant and number of leaves above the corn did not show significant statistical difference in the tested treatments. This phenomenon can be attributed to fixed number of inter-nodes in corn plant.Number of leaves in each hybrid plant is generally linked to its growth season duration as delayed-growing hybrids assume larger leaf level compared to early-growing varieties [KUCHEKI & BANAIAN, 1994]. In the states where sucrose amount in leaves is high, vascular sheath cells have larger osmotic potential, and as such, facilitate the loading action due to mobilization of sugar towards the vascular sheath cells [KUCHEKI & SARMODNIA, 1994]. According to what discussed above, the growth inducers have probably affected the yield by indirectly influencing the upper layers of plant organs.

Panicle length and number of panicle twigs

Application of growth inducers revealed significant contrast on the traits of panicle length ($p<5\%$) and number of panicle twigs ($p<1\%$). Number of panicle twigs decreased significantly under treatments of MARMARIN, HB_101, and INDOLE acid acetic; the maximal decrease belonged to EXIN treatment. Panicle length significantly increased in INDOLE acid acetic treatment while all other treatments exhibited no significant difference compared to control treatment (Figures 3 and 4).

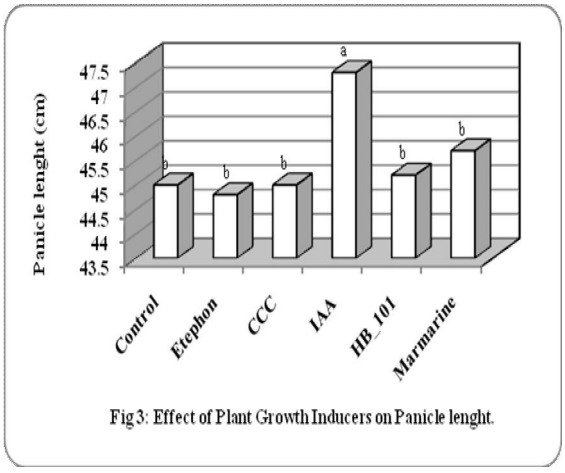

Fig 3: Effect of Plant Growth Inducers on Panicle lenght.

Small panicle in corn can be considered as a biogenic target because less shading will cover the terminal leaves which play substantial role in photosynthesis if number of twigs and length of panicle are reduced. Furthermore, the shortage of nodes can barely be assumed as responsible for infertility of ova and the reason is essentially due to delayed tasseling, which is in turn caused by deficiency of water, nitrogen and carbon hydrates [KUCHEKI & BANAIAN, 1994]. High yield might be expected through reduction of this trait in MARMARIN, HB_101, and to a smaller extent, EXIN treatments.

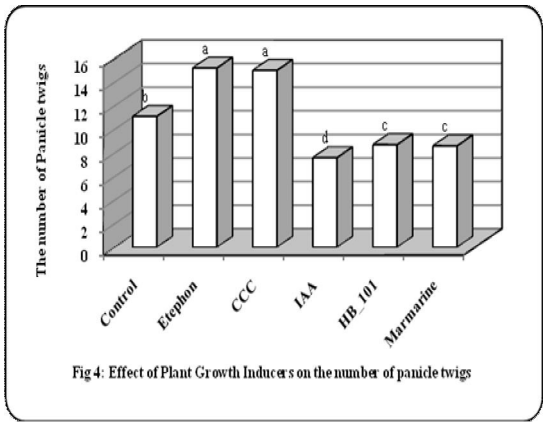

Fig 4: Effect of Plant Growth Inducers on the number of panicle twigs

Biological Yield

Biological yield of corn showed very significant statistical difference ($p<1\%$) in plant growth inducers treatments. The maximal enhancement belonged to MARMARIN treatment, and, ETHEPHON treatment caused a significant decline while CYCOCEL did not leave any significant effect on the biological yield (Figure 5). Grain and biological yields require appropriate equilibrium between the following agents: size of photosynthesis system and its consistency, photosynthesis rate, transfer (mobilization) and distribution of photosynthetic products to organs, number and size of grains and their capacity in terms of accumulation of photosynthetic products. And generally, supply of nutrients more than their absolute value determines the status of plant elements [KUCHEKI & BANAIAN, 1994].

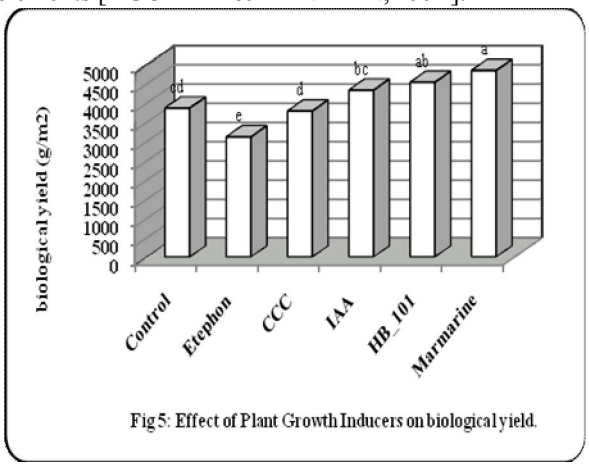

Fig 5: Effect of Plant Growth Inducers on biological yield.

Hormones affect distribution of photosynthetic products. Photosynthetic products are

accumulated in hormone-contaminated areas when compounds such as INDOLE acid acetic, CYTOKENIN, ethylene and Gibberellic acid are applied on the cross-section of stem. Atriplex which is a pasture plant in Australia needs sodium as a low-consumption element. Apparently, sodium is required as a low-consumption element for the plants having 4-carbon photosynthesis systems, which probably relates to function of this element in ionic balance [KUCHEKI & SARMODNIA, 1998]. In addition, exceeded application of algae compost leads to increased protein content in pasture grasses and influences the meat amount in livestock feeding on these pastures [Davis, 1981].

Weight of banana bunches increased 14 to 18 % by applying algae growth stimuli and considerable enhancement was observed for corn as well [BLONDEN, 1972]. CYCOCEL application reduced the plant height and contributed to improvement of grain yield in wheat due to increased number of grains per unit area [SHEKUFA & EMAM, 2005]. ETHEPHON application together with different amounts of nitrogen fertilizer caused significant decrease in plant height and improvement of grain yield [Foster & FARIS, 1992]. Based on the former discussions, presence of sodium and calcium elements in HB_101 and MARMARIN treatments could be a reason for enhancement of biological yield.

Harvest Index

Treatment of growth inducers demonstrated significant statistical contrast on harvest index ($p<1\%$). MARMARIN, HB_101, and INDOLE acetic acid improved this trait; the maximal increase belonged to MARMARIN and HB_101 treatments and no significant difference compared to control case was observed in other treatments (figure 6). Experiment results reveal the fact that mobilization of stem-accumulated matters, which comprise the excess products associated with photosynthesis prior to grain filling stage, was to some extent helpful in improvement of grain yield. This phenomenon is further noticeable in grain filling stage particularly in the event of stresses such as dryness and high temperature [EVESTIN et al, 1980; GALANGER et al, 1976]. Harvest index reflects ratio of photosynthetic products distribution between economical yield and biological yield [KUCHEKI & SARMODNIA, 1998]. Harvest index signifies ratio of grain yield to the biological yield, thus is less affected by the environment [FAT-HI, 1999]. Besides, 90% of increase in grain yield of fine-grained cereals mainly is due to improvement of harvest index [KUCHEKI & SARMODNIA, 1998]. Absorption rate of nutrients in corn declines after flowering [FAT-HI, 1999]. The amount of nutrients absorbed by plan does not solely constitute the total biomass or yield, but instead, the determining factor is nutrient consumption stage i.e. the stage in which the percentages of absorbed nutrients that form the yield are determined. This stage, unlike the absorption stage, directly depends on internal plant properties [EMMA & NIKNEZHAD, 1994].

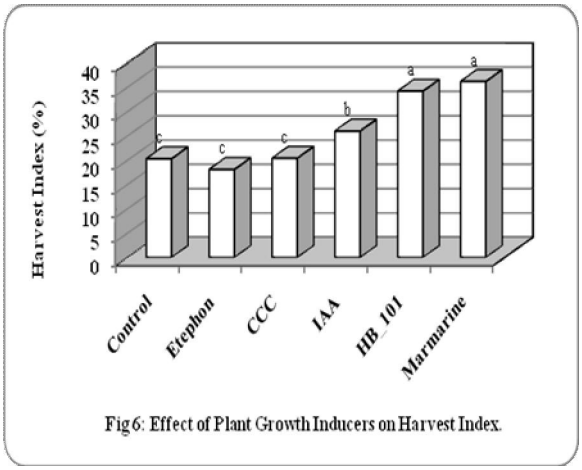

Fig 6: Effect of Plant Growth Inducers on Harvest Index.

Application of plant growth inducers one week before and one week after pollination stage can contribute to improvement of biological yield and harvest index in corn. For example, MARMARIN treatment enhances biological yield of corn through increasing the leaf surface durability and photosynthesis duration and rate, lengthening duration of graining and grain filling periods without reducing length of vegetative period and by indirectly or directly influencing the improvement of mobilization rate of photosynthetic products from origin to destination. HB_101 achieves the same goal through increasing duration and rate of photosynthesis and nutrient absorption due to availability of different minerals and elements in its compositions, especially calcium and sodium ions, promoting production of sugars in plant, which in turn, leads to improvement of mobilization and loading rates and further and faster discharge of products between origin and destination. Harvest index is also probably improved through influence of these substances on grain yield and its components. INDOLE acid acetic also affects biological yield and somewhat improves the harvest index through helping the enhanced dominance of terminal germ, distributing the photosynthetic products, and promoting the absorption of substances near the treated areas. Failure of CYCOCEL and ETHEPHON to influence yield and harvest index, on contrary to a couple of formerly conducted researches, could result from different application stage and plant type (sort of cereal). Nevertheless, in addition to achieving goals of

sustainable agriculture, improvement of vegetative yield and harvest index in corn by means of natural growth inducers such as MRMARIN and HB_101 (respectively derived and produced from algae and extract of plants) and also potential impact of these substances on yield of other cereals and even other pasture crops, could act as a preface for initiating new research works. However, extensive application of these compounds requires other researches to be carried out.

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Evaluation of Golshan Shabestari and Raz mashahed's characteristics

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Abstract : The first and the most important Sheikh Shabestari's literary work is a poem involving 993 theosophical distich in sixth omitted song which has sung in 1317 in response to 17 questions of Amir hoseini sadat harvi, because Sheikh arrived to the Sheikh Bahao din yaqoob tabrizi's assembly,shabestari responded to each distich by another distich as well ,then appended other distiches to previous distiches in order to develop "Golshan raz" poem. Most of Sufism and theosophists and Persian literature researchers agreed with the point that Sheikh Mahmud shabestari as famous stars of notion world and Islamic theosophy has acclaimed his dominancy to notion declaration with developing eternal literary work and including Sufis teaching for them, "due to applied accuracy and benefice ,however was accepted from Sufism sometimes named all Sufism teaching professions and most of sophisticated men put effort to describe and interoperate ambiguous and difficult points and subjects .'Sadatnameh" ," Haqol yaqin fi maerefeh Rabol alami", "Meratol mohaqeqin" mention Monifi 's literary work from Hazrat sheikh sado din Mahmud sabestari ,but his eternal literary work "Golshan raz" would be his most important and famous literary work that different descriptions have been written about it and is as One of shabestari's thesis which has read wrongly "shahed "or" shhednameh", no information is available from "mashahed "thesis and shabestari has named it in the end of fifth stage of Haqol yaqin thesis.
[Mohammad Bagher Toorang. **Evaluation of Golshan Shabestari and Raz mashahed's characteristics.** *Life Sci J* 2012;9(3):1689-1695] (ISSN:1097-8135). http://www.lifesciencesite.com. 246

Keywords: sheikh Mahmud shabestari, golshan raz, Hadiqaatol maaref, Haqol yaqin

Introduction

Sheikh saedo din Mahmud ebn amino din abdol karim is as the famous Iranian theosophists in the end of seventh century and first of eighth century, there is no accurate information about his life .sheikh was born in kei khatoon dominancy time in 1288 in Qasbeh, a city near to Tabriz and was also sophisticated and erudite in sultan Mohammad Khodabande and Aboo saeed dominancy in Tabriz .he returned finally to his hometown after some journeys to Egypt, sham and Hejaz which are mentioned in his book" Saadat Nameh' .at that time he was brilliant erudite in theosophy and theology ,nothing has mentioned in his literary work in basis of sheikh Mahmud religion, but Aqa Mohammad Basher Anvar Aboohari has mentioned in his thesis that he believes Shafee religion based on Asharian beliefs ,but regarding Sufism demeanor and the point that all Sufis know Amiral moemenin as lifesaver and join to Mohammadieh pontificate ,so shabestari 's love would be a definite fact .he believes in imam zaman religion like all shies and has mentioned the point in his book that world would be filled with justice and total peace would be developed as well. some authors has mentioned Baho din yaqoob and Amino din tabrizi followers ,but as it's mentioned in Rozatol janaan ,sheikh has utilized both of them .he is follower of MAHYAO DIN EBN ARABI IN THEOSOPHIIY and has codified some books and thesis during his life and also some literary work belongs to him.

Main body

Shabestari is ever biased like all sinless existence and believes human's freedom feeling as separation of god due to ego grasp. in fact human is an inexistent or privative order ,hence its meaningless to attribute freedom to him. believers are as freedom of angry volition, attributing strength, volition to human would be mistake and both "Moetazeleh" and "Asharieh"has mislead in this stage; first group acclaims that human has freedom in choosing his ego and second group knows him responsible for his actions by attributing obtain power.In shabestari opinion, human hasn't been born for accomplishing behavioral responsibilities, but another aim hasn't acclaim.

Lahiji "expounder" acclaims that his intention was in a way that he was like a pure mirror as a symbol of divine's nature and attribute .could we name mirror free due to object reflexion? Our duties has been fated from the past,divine action are unasked and inscrutable so why human would be responsible for his action ?is it unfair ?sheikh thinks that his action is not unfair ,but also would be a proof in confirming the perfect strength and divine adoption. Furthermore, the purpose of enforcing human for accomplishing actions which haven't any adoption would enforce

him to ignore the world which won't be possible for him to obey the direct way and obey the religion."They ordered According to religion, and they admired his internal existent, because maybe become disable of commandment, all of a sudden would be vanished and mislead".

Which stages could reach the person to evolution stages? in his opinion, human is born as origin and evolution of creation and would be the purest and most important creator ,but would be decline to the nethermost level due to fall in this sordid world ,his position is continuously against with unity position ,but human identify his weakness based on the obtained light via chimerical force or rational ability and considers demeanor against the first manner ,this demeanor would be from possibility to reality ,intension to unity ,good to bad ."a passenger is a person who passes soon, makes clear like fire of smoke ,his convenance discovers in this group, it is obligatory to give up sin and defects, inverse of his life's convenance, have to continues life in order to get perfect human "

There is 3 stages in this demeanor, the first stage would be named absorption, here divine light would be radiated via human's duties and actions and would be in a way that Sufi assumes all other objects imaginary and unrealistic, nothing except god would own comprehension in the second stage, divine light would be radiated via divine attributes, and so Sufi assumes attributes of divine. Third stage would be the time that Sufi receives light and discovery from the real nature and sight of the order reality .nothing is available for him and all objects existence would be from the divine existence, When Sufi achieves this stage, would become perfect and achieves unity of divine in a way that angles and prophets couldn't modulate with him, all bigeneric people would be seen in light and human would reach the stage which had started his demeanor from there. Shabestari obeys authors's general method in the prophecy and pontificate essence announcement. Pontificate has more generality than prophecy. At first outlook, saint and prophet would be all saint, pontificate wouldn't be obvious for Sufi whereas is clear in prophets. Patron saint obeys prophet and achieves superior positions and would be unified in union realization with god. The first pontificate stage is the stage which prophecy and pontificate were both obvious in the world and would be ended by Prophet Mohammad's perdition. Pontificate was continued and stage started to genesis after the last prophet. one day the last patron saint would be appeared and evolution of pontificate would appear and both world would be ended with his appearance, he would be perfection which former patron saint were before him ,he would bless all world like last prophet, he would be satisfied in peace and safe establishment, justice and equality would be established. Nevertheless, this earth which is as right emanation wouldn't end ever, if it could be acclaimed that divine would stop the emanation, and then time wouldn't be mentioned. This world and next world would be correlated with each other and nothing would be between them .another world is currently ongoing. Whatever we acclaim it as this world and that world would be conjugational names, whatever shabestari names creation of Daemo Tajadod by obeying Ebn Arabi would be endless of perdition and new creation in the future world, human wouldn't have body and his body would be rare and clear .our actions and our current life's mental inclination would be formed objective formation and would obviously substantiate. Good inclination would be formed as light (heaven) and bad inclination as fire (hell).Golshan Raz: parable of death declaration and other world new appearance at death time."Creation and annihilation is in both world like creation and being chosen as god's messenger, human is ever in effort of another human 's birth however his lifetime be long".

Individuality or human body would be disappear after death, subsequently intension would be perished in unity .superior human would be glorified and this wouldn't be objective and ostensible, but also would be self-emanation.

Sheikh literary work

Shabestari in this poem has responded questions by subtitles such as "exemplification" and "rule" declaration of union religion of this book essence which won't add anything to the Ebn Arabi declaration .nevertheless, Sheikh has announced this subject clearer and more accurate from his religious master.

He acclaims in Golshan raz that: primal description essence would be existent and inexistence would be extinct .there is not anything except unity in the existent world, possible and obligatory haven't been in separation, they were oneness from the first if it be visible from one point, it would be union and if it be visible from another point, existent would be propagated. The only comparison would be the reality union aspect whereas propagation aspect is imaginary, reality would be union but its names are different and this propagation would cause variety .Golshan Raz has been described and interoperated by different people from eighth century due to its necessity in theosophical literature and constancy and its allegorical which seems the oldest. Description has written by shabestari's child in Golshan Raz and the most popular description has been known the "Mafatihol ejaz shamso din lahiji"

Saadat Nameh

Is a poem in verbal matters in the superficial content of "Hadiqatol Haqiaqt "of erudite sanaee qaznavi in 1075-1135 involving 3000 distiches and divided in 4 stages and each stage involves anecdote and articles .Shabestari intended to sing his book in 8 stages but he was dissuaded after finishing 4 stages .Sheikh has mentioned his long journeys and meeting erudite in this poem and has mentioned dignities and five famous Azerbaijan theosophist's logion in 6th century such as Baba hasan sorkhabi,baba faraj tabrizi,khaje mohammad kajejani,khaje abdol rahim tabrizi and khaje saeeno din tabrizi.

Haqol yaqin fi marefeh rabol alamin

Haqol yaqin is a theosophical thesis involving one introduction and 8 stages and its subject is theatrical theosophy matters .available discussions mention Golshan Raz that this content unity has been utilized by Hadiqatol Marefeh's author in describing some of Golshan Raz's distiches .introducing mashahed thesis could be necessity of this thesis that has been mentioned in the end of fifth stage. Book's prose is relatively complicated and involves referring the Quran and citation.

Haqol yaqin has been influenced by literary work of Ebn Arabi's logion and methods and notions declaration.

Meratol Mohaqeqin

As one of sheikh's thesis has 7 stages and involves simple prose. This thesis is composed of philosophy and theosophy in grasp and cognition of ego and theology, as the obvious stylist comparison of this thesis composed with other shabestari's literary work, so his adoption would be discussed.

Merajieh

Is a thesis in explaining quality and formation of meraj. Translation of menhajol abedin, this thesis is a translated by menhajol abedin of imam qaznavi

Kanzol Haqayeq

This book has been written coincidently with Zadol Mosaferin by Mir Hosein Harvi,Chareyeh vesal,Leili and Majnoon, and Mifenderski 's elegies in 1933 which all of them has publicized in Tehran, Kanzol Haqayeq belongs to Mohammad Kharazmi based on authors declaration.

Mashahed

As its misread as "shahed" or "shahednameh' was a thesis that sheikh had codified it in "its superiority and love and its order" and its name has been mentioned in the end of fifth stage of Haqol Yaqin thesis. a point which has caused mistake in this thesis 's name would be thesis's subject that Sheikh has mentioned it in Haqol Yaqin ,the fact shows that because readers hadn't seen thesis so they concluded from Haqol Yaqin that because thesis 's subject is its superiority ,difficulties and its order ,so Shahed or Shahednameh would be better alternative names.

It's obvious that similarity of Mashahed and Shahed could be origin of this mistake, but some reasons could confirm our declaration:

1-in all three available copies, Hadiqato Maarefeh description by Shojao din Korbali has been written in Golshan raz

"Poor study would be named Haqol Yaqin of sheikh thesiss, love and kindness research document was named by another thesis by Mashahed name" concluded that in Haqol Yaqin copy which named korbali study, thesis name was Mashahed and Shahed or Shahednameh was wrong names.

2-mashahed is plural form of mashhad and is the name of one of shah daee shirazi's sixth poems in 1408-1466 which this poem has been divided to parts with mashhad name .it's definitely acclaimed that if shah daee 's book name is mashahed ,what relation could have with shabestari thesis ?it would be correct, but such a this book 's name wasn't common ever. there is not any authentic reason based on shahed or shahednameh accuracy ,one of references which have acclaimed thesis name directly shahed in love and lover announcement would be Majalesol Oshaq book that author wrote funny anecdote about shabestari coincidently with writing book's name which is not real.

Shabestari is One of sheikh esmaeel and sheikh ebrahim's acquaintance, shahednameh thesis has written about love and lover announcement and had close familiarity with them and as its acclaimed in Golshan Raz ,people's view toward him was his superiority and announced that repudiators has regretted and solicited him.his relatives asked his recovery and continue their way and he responded:

"My love is hot like a burning candle in all the night, one day if I be sad means my love is far from me, and this day wouldn't appear in whole my life"

Its obvious that people who fabricate as well as this couldn't be poor at writing a word .a significant point is that meaningless fabrication caused a scrutinized researcher such as doctor Zarin Koob who has doubt about it in a way that knows shabestari 's adoption accuracy of Mashahed thesis as thought point.

3-another point in Haqol Yaqin thesis corrected by doctor Reza Ashraf Zade which is the oldest available copy of Haqol Yaqin, corrector wrote Mashahed instead of Shahed or Shahednameh in the text ,but has introduced Shahed as Shabestari's literary work in the introduction of Haqol Yaqin thesis ,nonetheless Mashahed has been mentioned in his corrector's text. As it could be acclaimed that he was

unaware of adventure or Mashahed couldn't be acceptable for this thesis, also doctor Samad Movahed has written about this:

"he acclaims another literary work by name of Shahed or Mashahedeh's thesis in Haqol Yaqin book .we don't know whether this book is the book which Mohammad lahiji and Rozatol Janan and Reza Qoli khan 's authors named it Shahednameh or another meaning in explanation of love positions and love secrets .

Sheikh's opinion

By reviewing Sheikh Mahmud shabestari's literary work, it could be concluded that our disability in cognition of god's inherence is generated of our closeness with him .inherence as absolute light is invisible in inexistence of absolute darkness .nobody could directly look at sun but its reflexion could be seen in water. Relative inexistence is like water and is symbol of Merat of absolute light that justice emanation has radiated in it. This relative inexistence is like stable reality in Ebn Arabi instruction that reflexes divine light based on his natural abilities. Divine light was as hidden magic but when it reflexes in Merat, sorrow would appear .however inherence was union, propagated in this process .shabestari acclaims union issuance in Ebn Arabi method .the first issue is from general sageness inherence that is Hadiaat stage, second issuance is the general ego. The last issuance in this major would be human that is the ultimate creation. Subsequently, superiority, dignity, celestial seven skies, quadruple elements, ternal ceremonies, recourses, flora and fauna .the last issuance would be human who is the ultimate creation. However, human is temporally the last creation in this sequence but is logically the first, as tree is from a seed.

All creatures have been created for Him whereas He, The most superior creator or divine symbol has been created for Himself .He is God of some insignificant and trivialness elements, nonetheless these elements are fundamentally for his behavioral evolution .one side of mirror has to be black altogether in order to reflect on objects .if this mirror was all clear and crystal, it wouldn't utilize as mirror anymore.

"If back of mirror be dark and blear, it would show the portrait from another side"

All objects have been created to obey human due to the fact that human is the ultimate purpose of creation. All different names are divine, he convenes all names inside himself due to the fact that human is an obvious reflection; hence all creation is inside Him .He is the most exclamatory creature of God and he is beholden to Him, all his strength, sageness and volition belongs to God.

In Shabestari's viewpoint, softhead person is considered useless .sageness way is a complicated, long and inextricable way. Philosopher is squint that sees everywhere in two side.

"If Philosopher be squint, people wouldn't be seen same"

He starts his activity with understanding of material s. He argues the fundamental existence is based on this fact and assumes it separated and alien from the possible existence.

"If Philosopher be wandered, nothing would be seen except objects, obligations would be proved in places and also would be wandered of main inherence "

Shabestari acclaims in basis of correlated causality reasoning that fundamental existence is in creation conduction .reasoning conduction is totally wrong in his opinion ,the possibility of god's sageness wouldn't be possible via possible way ,because possibility hasn't any relation with fundament .in another meaning , sun would be discovered via candle light by human"

Therefore, the best method would be giving up the rational reasoning and appearing the theosophy world.

"All objects would pray while entering divine world"

Knowledge which obtains of disputative proof would induce the person to sleep whereas theosophy wakes him up .the person has to go ultra moon, sun and stars that in his opinion would be respectively symbol of sensational, imagination and luculent sageness perception.

Sheikh specifically rejects sageness effectiveness in theosophical assertion in sixth question of Golshan Raz .he believes a way separated of ultra sageness that person could understand reality light via it .this human 's chimerical force is cryptic like fire inside stone and if this fire blazes ,all the world would be brightened .

"human could be superior to all world that could identify all hidden mysteries 's conditions such as fire in stone and metal, god gave breath to human, when stone and metal collide with each other, both world would be brightened of their light"

In tenth question while science is being discussed, would be acclaimed that the intention of sageness is not an object causing people to achieve world's force and regards.

"When mud and water be mixed together, god put spirit in them, while using elements, divine sign would be identified "

Divine emanation is not just in good objects, but also is in objects which are considered bad objects .because god is the only existence and reason of all objects existence, therefore all objects unexceptionally would appear light .logical status of existence union is in a way that good and bad altogether are equal and are symbols of god and have equal base, but when

reviewing common beliefs, we would compare them and good attributes belongs to god and bad one to devil.

Results and Discussion:

Bibliography of Shabestari's literary work

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3-Brawn, Edward; Iran's literature history, Saedi and jami ,translated by A;I asqar Hekmat
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9-Sharif.M;religion history in Islam, university publication centre ,second edition, third part of fourth stage ,forty three article ,written by B.A. Dar, translated by doctor Ali asqar halabi, this is an analysis about some of shabestari ' s beliefs based on golshan raz.
10-Zarin koob, Abdol hosein;(1996),research in Sufism,Amir kabir publication,Tehran
11- Zarin koob, Abdol hosein;(2001),an essay in basis of "review the golshan raz" in the water's image collection,Tehran.
12-Olodaq, Soleiman;(2008),Ebn Arabi ,translated by Davood Vafaee ,centre publication

However this book is not written in basis of shabestari, reading it would be necessary for understanding Ebn arabi's beliefs which is the most important reference of shabestari' s beliefs .this literary work has been written articulate and easy and author has put effort to acclaim difficult beliefs of Ebn Arabi with simple and clear phrases. Also translator has overcome to translate the book from Azeri to Persian. Hence, it could be effective for educated readers.

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14-Movahed, Samad;(2002),sheikh Mahmud shabestari 's literary work collection , Tahoori publication, Tehran.

Emendations and translations of Golshan Raz

Various editions of this book has been presented by researchers , but the best emendation of this book is accessible for people by Doctor Samad Movahed in collection of shabestari literary work .this precious book has been translated to other languages as well as following:

1- Ordu, Molavi Ahmad hasan soeti.
2-Torki, whose pen name is shirazi has translated to torki.
3-torki, as Jam delnavaz ,Mahmud halavi.
4-Germanic, Doctor Tolog, 1825
5- Germanic, Hamer poor gashtal, 1838
6-british, win fild, 1880

Parodies which have accomplished of Golshan Raz

1-Golshan Romoozi, Mohammad romoozi nashlaji kasha's literary work (diseased in 1565)
2-Azhar Golshan, Mirza ebrahim adham, eleventh century's famous poet (diseased in 1607)
3-new golshan raz, Eqbal lahoori's literary work

Golshan Raz descriptions

Different descriptions of Golshan Raz as theosophical book have been written which acclaims the necessity of this book. Some descriptions are introduced here, then the most important description "Mafatihol ejaz in description of golshan raz" as lahiji's literary work would be perused with more details here.

1-Golshan Raz's description, sheikh rooh bakhshan badkhashan literary work,calif seid mohammad nor bakhsh has written it in the first period of ninth century .
2- Golshan Raz's description, as Vasit description, by seid mohammad madani neishaboori, known as mir makhdoom ,he was follower of Qasem anvar and has been killed in 1524
3- Golshan Raz 's description, as open bud ,a person by name of eino din has written golshan raz as more completed poem and has called it open bud
4- Golshan Raz's description, written by saeeno din ebn mohammad torkeh esfahani(deceased in 1433)
5- Golshan Raz's description, written by Ahmad ebn moosa in 1441
6- Golshan Raz's description, written by Molana abdol rahim khalvati(deceased in 1455)
7- Golshan Raz 's description, as Nasayem golshan ,written by Mahmud ebn hasanol mohseni,known with shah daee(deceased in 1466)
8- Golshan Raz's description, seid yahya khalvati shirazi(deceased in 1464)
9- Golshan Raz's description,as hadiqatol ,aaref,written by shojao din korbali, initial time 1452
10- Golshan Raz's description, as Golzar Damask, Seid Shahabo din ahmad Qavimi,written in 1475

11- Golshan Raz‘s description, as Mafatihol ejaz fi sharh golshan raz,written by Shamso din mohammad ebn yahya lahiji nor bakhshi,whose pen name is Amiri(deceased in 1507)
12- Golshan Raz‘ s description ,Khaje hosein ebn khaje sharafo din abdol haq ardebili,known with divine and famous with kamalo din (deceased in 1543)
13- Golshan Raz ‘ s description, Nemat allah ebn mahmud,known with baba nakhjavani and sheikh anvan(deceased in 1514 or 1516)
14- Golshan Raz‘s description,jalalo din mohammad sediqi davani(deceased in 1503)
15- Golshan Raz‘s description, known with shaqayeqol haqiq, Ahmad elahi ,at the end of ninth century with sultan abol fath bayazid ebn morad name
16- Golshan Raz‘s description, Shah mozafaro din ali ebn mohammad shirazi roomi(deceased in 1516)
17- Golshan Raz ‘ s description, written by Jalalo din Mahmud, written in 1576
18- Golshan Raz ‘s description, written by khaje moeeno din mohammad ebn mohammad, known with dehdar, whose pen name is fani, this description is a summarization of lahiji description (deceased in 1607)
19- Golshan Raz‘s description,mola abdol razaq fayaz lahiji qomi(deceased in 1051)
20- Golshan Raz‘s description, as meshvaq thesis or mola mohsen feiz description (deceased in1019)
21- Golshan Raz‘s description,Mohammad ebn mohammad hosein,is writtenin the end of 13 century
22- Golshan Raz‘s description, majmooelo favaed or technique description ,that has complained to lahiji .writer hasn’t been specified .
23- Golshan Raz ‘s description ,as mahmoodieh thesis ,mirza abdol karim rayzo din zanjani,whose pen name is ojoobeh and known with aref alishah (deceased in 1875)
24- Golshan Raz‘s description, written by Mohammad ebn Mohammad ali Sabzevari, as follower of haj mola hadi sabzevari, sangi edition, Tehran
25- Golshan Raz‘s description,haj mirza mohsen emad ardebili,whose pen name is beh hali, Tehran
26- Golshan Raz‘s description, Khayro rasael description,a poem of seid mohammad ebn mahmud hoseini lavasani,known with Osar which has endee in Tehran
Recently effective description has been written in basis of some important of Golshan Raz which definitely involves points and advantages for readers
27-sheikh mahmud shabestari’s Golshan Raz description and texts, written by doctor Kazem dezfoolian ,Talaeehe publication, Tehran ,no 1382
28-simple description of Golshan Raz , written by doctor Behrooz Servatian ,international edition company

Mafatiho ejaz in Golshan Raz description

As mentioned, this book is the perfect Golshan Raz’s description .it’s necessary at first to get a bit familiar with characteristic of this literary work‘s writer .Mohammad Ebn Yahya Ebn Ali Gilani Lahiji Noorbakhshi known with Shamso din whose pen name is Amiri is the theosophist and poet of ninth and early tenth century. precedent remained silent about his birth year and some succedent know his birth year 1437.he came to Seid Mohammad Norbakhsi when he was young and became the perfect follower after repenting and isolation and discussing .in basis of this adventure, it could be concluded from Mathnavi poems”Asrarol shouhod “ that ,he came out of Lahijan after falling love and by conduction of a man for the intention of visiting divine and he went to visit his master with two other people who got familiar with each other in way.Lahiji acclaims that he has helped other with Mohammad noorbakhsh for 16 years and has asked help from his master due to get high dignities which are mentioned in golshan description, as he is superior sheikh of Noorbakhshieh method ,at first he was follower of seid Mohammad Noor Bakhsh and he went to shiraz after death and was conducted there in his method and has been become follower of Fars ’s Noorbakhshian .he got brilliant abbey which was known with “Noorieh abbey” after residency in shiraz. That mentioned century’s dominators has allocated many domains and has asked demand from his dignity.
Lahiji has deceased in Shiraz in1507 and his sepulcher is in abbey .some of Lahiji’s literary works are as following:
A –poem works
1-poem divan
2-Asrarol shouhod is a mathnavi in sea of ornament and more than 3000 distiches involving researches and parables in basis of theosophical and theology subjects
3-Molavi mathnavi choice: Lahiji has written this work in 1470 and has described the Mathnavi problems as poem
B-outdated works
1-Mafatihol ejaz in Golshan Raz description
2-six thesis involves thesis which have edited in the end of Asiri divan

Lahiji acclaims that followers of good way asked him to write a description of Golshan Raz book whereas he avoids it until the bibliomancy who read in 1473 started to describe Golshan .Lahiji illustrates the main reason of writing this description in the end of Golshan Raz that “the reason of describing this book was having perception to obey researchers and didn’t obey others and this book ”Golshan “has found the ultimate excellence and I tried to describe its points and matters.Lahiji description is a complete description involving all Golshan Raz distiches

.expounder method is that at first if he needs to explain a word would acclaim it ;then describes theosophical and philosophy description of distich and then refers to citations, poems ,verses and theosophists 's logion ,meanwhile description of Sufism teaching between Ebn Arabi phrases and its expounders has conflated with sheikh 's "KEBROOYEH "teaching such as Mir Seid Sli Hamedani. if the described distich in another copy had been reordered differently with his copy, conflict acclaim and new meaning description would be perused . After finishing Golshan description, Lahiji sent it to Harat for Jami and Jami wrote these distiches in response to him and sent it to sheikh.

"Poor people would also reach dignity due to his kindness , flowers would blossom in spring, He considers us, and maybe we get high dignity"

Current theosophist researcher (Leonard Loeezen) acclaims about this description that:

Two groups of theology or theosophy would be significant in lahiji's golshan raz description

1- romanic erotic description of Molavi 2-Ebn arabi theosophy and his followers such as theosophist poet, Araqi and Maqrebi.

Lahiji is a famous theosophist whose abilities are same as shabestari and his description is like shabestari's Mathnavi. Descriptions of his personal dreams and moods and experiences has been concluded of involved theosophy and poem of Iran Sufism in inter centuries and other references of Romanic ,western and Iraq divans .This book is definitely originated from the same origin of shabestari poem. Therefore it's sufficient to attract attraction of Iranian Sufism's lovers.

08/01/2012

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Nuclear Waste Effects on Human Body

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Abstract: Regarding the fact that fossil fuels are coming to an end soon, the matter of using nuclear energy is getting a big deal of attention. But as using nuclear energy increases matter of waste disposing should be handled more delicately. ill effects of nuclear waste on the human body are a matter of concern which to this day has been investigated repetitively. In this article we wish to extend these investigations with the hope of a day without contamination or at least less contamination. We first illustrate some effects of using nuclear energy and effects of nuclear waste on the human body. Then we investigate some ways of disposing nuclear waste and their advantages and disadvantages. Finally we try to make some suggestions for a better dispose of nuclear waste.

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Keywords: Nuclear; Waste; Human; energy

1. Introduction

1-1 Nuclear energy; a development or a danger

Through last 30 years global need for energy has increased considerably. In 1960 universal energy use was 3.3Gtoe which exceeded 8.8Gtoe by 1990. This means an increase rate of 3.3 per year and altogether it has shown 166 percent of increase and currently the rate of energy use is approximately 10 Gtoe/year. Then it's fair to conclude that in the next century it will increase to a point in which fossil energy could not respond to global need. First 5 Megawatt nuclear power plant was developed in Soviet Union and first commercially used 50 Megawatt nuclear power plant was in Britain. In 2004 nuclear energy was responsible for nearly 6.5 percent of global energy need. It was responsible for 15.7 percent of electrical energy. In 2007 IAEA announced that there are 439 nuclear reactors in 31 countries all around the world. The United States which obviates 20 percent of its need for energy through the use of nuclear energy is in the first place, followed by France in second place.

1-2 How does it work?

The science of atomic radiation, atomic change and nuclear fission was developed from 1895 to 1945, much of it in the last six of those years .

Over the years of 1939-45, most development was focused on the atomic bomb .

From 1945 attention was given to harnessing this energy in a controlled fashion for naval propulsion and for making electricity .

Since 1956 the prime focus has been on the technological evolution of reliable nuclear power plants.

1-3 Exploring the nature of the atom

Uranium was discovered in 1789 by Martin Klaproyhkith, a German chemist, and the element was named after the planet Uranus.

In 1896 Henri Becquerel found that pitchblende (an ore containing radium and uranium) caused a photographic plate to darken. He went on to demonstrate that this was due to beta radiation (electrons) and alpha particles (helium nuclei) being emitted. Paul Villard found a third type of radiation from pitchblende: gamma rays, which were much the same as X-rays.

Then in 1896 Pierre and Marie Curie gave the name 'radioactivity' to this phenomenon and in 1898 isolated polonium and radium from the pitchblende. Radium was later used in medical treatment.

In 1898 Samuel Prescott showed that radiation destroyed bacteria in food. In 1932 James Chadwick discovered the neutron.

Physicist Enrico Fermi, in his experiments, was mostly producing heavier elements from his targets, but also worked with uranium producing some much lighter ones. At the end of 1938 Otto Hahn and Fritz Strassman in Berlin showed that the new lighter elements were barium and others which were about half the mass of uranium, thereby demonstrating the occurrence of atomic fission.

Lise Meitner and her nephew Otto Frisch, working under Niels Bohr, then explained this by suggesting that the neutron was captured by the nucleus, causing severe vibration leading to the nucleus splitting into two not quite equal parts. They calculated the energy release from this fission as about 200 million electron volts. Frisch then confirmed this figure experimentally in January 1939.

This was the first experimental confirmation of Albert Einstein's paper putting forward the

equivalence between mass and energy, which had been published in 1905.

1-4 Harnessing nuclear fission

These 1939 developments sparked activity in many laboratories. Hahn and Strassman showed that fission not only released a lot of energy but that it also released additional neutrons which could cause fission in other uranium nuclei and possibly a self-sustaining chain reaction leading to an enormous release of energy. This suggestion was soon confirmed experimentally by Frédéric Joliot and his co-workers in Paris, and Leo Szilard working with Fermi in New York.

Bohr soon proposed that fission was much more likely to occur in the uranium-235 isotope than in U-238 and that fission would occur more effectively with slow-moving neutrons than with fast neutrons, the latter point being confirmed by Leo Szilard and Fermi, who proposed using a 'moderator' to slow down the emitted neutrons and subsequently Szilárd patented the idea of a nuclear reactor with Fermi. Bohr and Wheeler extended these ideas into what became the classical analysis of the fission process, and their paper was published only two days before war broke out in 1939.

Another important factor was that U-235 was then known to comprise only 0.7% of natural uranium, with the other 99.3% being U-238, with similar chemical properties. Hence the separation of the two to obtain pure U-235 would be difficult and would require the use of their very slightly different physical properties. This increase in the proportion of the U-235 isotope became known as 'enrichment'.

The remaining piece of the fission concept was provided in 1939 by Francis Perrin who introduced the concept of the critical mass of uranium required to produce a self-sustaining release of energy. His theories were extended by Rudolf Peierls at Birmingham University demonstrating that a chain reaction could be sustained in a uranium-water mixture (the water being used to slow down the neutrons) provided external neutrons were injected into the system. They also demonstrated the idea of introducing neutron-absorbing material to limit the multiplication of neutrons and thus control the nuclear reaction which is the basis for the operation of a nuclear power station.

A group of eminent scientists known as the MAUD Committee was set up in Britain and supervised research at the Universities of Birmingham, Bristol, Cambridge, Liverpool and Oxford. A final outcome of the MAUD Committee was two summary reports in July 1941. One was on 'Use of Uranium for a Bomb' and the other was on 'Use of Uranium as a Source of Power'.

The MAUD Report concluded that the controlled fission of uranium could be used to provide energy in the form of heat for use in machines. It concluded that the 'uranium boiler' had considerable promise for future peaceful uses but that it was not worth considering during the present war.

The reports led to a complete reorganization of work on the 'boiler'. The reports also led to high level reviews in the USA, particularly by a Committee of the National Academy of Sciences, initially concentrating on the nuclear power aspect. Little emphasis was given to the bomb concept until 7 December 1941, when the Japanese attacked Pearl Harbor and the Americans entered the war directly. The huge resources of the USA were then applied without reservation to developing atomic bombs.

Revival of the 'nuclear boiler'

By the end of World War II, the project predicted and described in detail only five and a half years before in the Frisch-Peierls Memorandum had been brought to partial fruition, and attention could turn to the peaceful and directly beneficial application of nuclear energy. Post-war, weapons development continued on both sides of the "iron curtain", but a new focus was on harnessing the great atomic power for making steam and electricity.

It was clear that this new form of energy would allow development of compact long-lasting power sources which could have various applications, not least for shipping, and especially in submarines.

The first nuclear reactor to produce electricity (albeit a trivial amount) was the small Experimental Breeder reactor (EBR-1) in Idaho, in the USA, which started up in December 1951.

2. Nuclear waste

- Nuclear waste is irradiated or used nuclear fuel
- Composed of fission products
- Nucleus of atom splits
- Composed of trans uremic elements
- Chemical elements with an atomic number greater than 92-Uranium
- Waste results from using nuclear fuel to produce electricity
- Referred to as high-level waste because it’s very radioactive
- Emits ionizing radiation or ionizing particles which is harmful to humans
- Tissue damage
- Cancer

Nuclear waste disposals; a matter of high importance

Over 1940s the United States has generated 75000 metric tons of waste which is expected to double by 2050. Over 121 facilities over the country are responsible for storing this waste on site.

Geological disposal

Waste should be stored deep in the ground where it would not distribute. Conditions for a safe disposal are:

1. deep coal resources
2. Known hydrocarbon resources
3. Oil shale
4. Aquifer development for groundwater use

Other methods of disposal include:

- Transmutation: Transform one element into another through nuclear reactions or radioactive decay
- Space Disposal

2-1 ill effects on the human body

The main disease caused by nuclear waste is bone cancer. Although it has other effects, bone cancer is in the center of attention. Destroying DNA, causing syndromes, and some kinds of cancer are the main diseases which are caused by nuclear waste. These diseases have long term effects which even affect next generations. The most dangerous radiation amongst three (alpha, beta and gamma) is gamma, penetrating tissues and cells in the body and destroying DNAs. In Gamma radiation particles are just similar to X-rays. The only difference is that they have shorter wavelength. Nuclear wastes contain so many materials which emit radiations of high danger.

Another danger is Americium. 241 isotope of this element was created in 1944 in nuclear reactors. This element is a source of Gamma radiation. It's highly toxic and should be handled very delicately.it can enter the human body through breathing or through skin. It aggregates in bones and disintegrates gradually. Then it starts to emit dangerous radiations. These radiations are an inner cause for all the aforesaid diseases.

Also radioactive dusts generated around exploratory drillings are really hazardous for the human body. It can be disseminated through streams and creeks to the cities and start a disaster.

At last let's don't forget the Chernobyl and the pregnant mothers who were forced to an unwanted abortion because of the radioactive radiations.

2-2 how to prevent these effects

Using appropriate methods of disposal for nuclear waste is the best way to prevent bad effects of nuclear waste. Concentrating and isolating, diluting and discharging, and letting the waste to decrease radioactivity naturally are some ways of disposing safely. There are rules to be followed on this matter. Rules of GSR 125 atomic energy rules govern the transfer and disposal of these certain kinds of waste.

2-3 Different types of nuclear wastes

1. Low-level

Low-level wastes are the least dangerous radioactive materials which aren't able to radiate for a long time. The garment which is used by the people involving with these material, tools they use and filters are low-level wastes. This type doesn't need any special treat and these wastes are treated as normal wastes. They are usually burnt and buried under sea or in dry lands.

2. Intermediate-Level

This type includes chemical sewage, metal coats in fuels and most of the wastes from nuclear reactors. These types aren't able to radiate for a long time but they need to be covered carefully since in their short life period they have a considerable amount of radiate. So, they are usually kept in concrete blocks or in special warehouses.

3. High-level

One of the examples of this type is the waste from the nuclear reactor's fuel, maintenance of which is way harder and more expensive. They should be covered in a special coat and kept in stores at least 1.5 km under the ground and in temperatures below zero.

2-4 Steps to manage these wastes

The steps to manage these wastes are

1. Temporary store keeping

The fuel used up in a reactor is very hot and radioactive and radiates a lot of radiances and ions. So, not only they should be cooled but also they should be stopped from radiating radioactive radiances. There are pools beside each reactor for storing used up fuel. These pools are full of water. They are made of concrete reinforced with stainless steel with 8 meters of depth. Water not only cools down the bar of used fuel but also acts like a screen in front of radioactive radiates. As the time goes by the radiation decreases to one tenth of the amount it was at time it came out of the reactor and also the temperature cools down too.

2. Reprocess final storage

After separation high-level nuclear wastes are heated to change into powder. After this process which is called calcification, powder is mixed with glass to be stored in a container. This process id called glassification. Liquid glass is stored in a container made of stainless steel and kept in a stable (geographically) place. After one thousand years the radiation goes back to normal. To this day this point has been the end of a nuclear fuels cycle.

2-5. Some ways to remove pollution

Characteristics of nuclear wastes at the time of quench are:

1. Appropriate heat conduction
2. Resistance to any chemical breakdown
3. Being solid
4. Leakage control and the least solvency in water
5. Having the least mass possible
6. Resistance to pressure and impact

Gathering and transporting radioactive wastes

International Atomic Energy Agency (IAEA) has categorized solid radioactive wastes to four categories:

First degree- wastes with radiance below 0.2 rad per hour which generate Gamma and Beta rays. These wastes could be transported or buried without any special regulation.

Second degree- wastes with radiation from 0.2 to 2 rad per hour which generate Gamma and Beta rays. These wastes must be transported in special containers with cement or lead shell.

Third degree- wastes which generate Gamma and Beta rays but the amount of Gamma ray is not considerable. Radioactivity in these wastes is more than 2 rad per hour. These wastes must be transported exactly as regulations of IAEA say. Bases for these regulations are: using coated containers and carefully eliminating any danger for living creatures while and after burial. Burying these wastes under oceans or in vast deserts has been protested hardly. Sending these wastes to outer space with missiles was another way which has lots problems and is considered as being irrational.

Fourth degree- these types of wastes generate Alpha ray which has a long half-life. Their radiation is usually measured by Kory in m^3.

2-6. Different methods of burying solid nuclear wastes

1. Temporary storing
2. Final storing so that they are reachable
3. Expulsion to natural frigid lands (e.g. North Pole)
4. Expulsion to seas or oceans (the Illegal way)
5. Expulsion to space (the Illegal way)

Different methods of burying atomic wastes:

a. Temporary storing

b. Final storing so that they are reachable:

Although final storing and final removal is economical, it has some disadvantages like:

These wastes aren't reachable, so they cannot be removed by better ways which are found through time

To store this type first steel cylinders with 30 meters of diameter and 3 meters of height are sent to the place. For temperature exchange, around these cylinders are air or cool water. In burial process vicinity of those cylinders are covered by soil around 10 ft. and probably using spaces between soil particles the heat will be conducted out.

2-7. Suitable places to bury solid wastes

Some suitable places to bury solid wastes are:

1. Salt marshes with thick beds
2. Clay rocks formed from sedimentation of under pressure clay
3. Hard crystal rocks like granite rock formed in high temperature

Two major methods in permanent storing

1. Temporary storing is done carefully in an appropriate place regarding rules and regulations. First a well with 3000 meters of depth is dig and then tools are transmitted to the bottom of the well. After this step, channels of 1000 meters deep are dig horizontally and wastes are placed in them. Finally 3/4 of their height is filled with soil and the remaining part is filled with protective material. So digging and loading will be done one by one regarding the amount of waste.
2. Wells of 6000 deep are dig and 2000 meters of them is filled with waste and the rest with protective material considering the radioactivity of wastes.

Other methods

Burial in North Pole

Ice layers in North Pole are of a good thickness. These areas are suitable places to bury wastes because their far away from human beings but only if they are not a danger of earthquake. Another advantage is low temperature which conducts heat out of reservoirs.

Disadvantages:

For example the possibility of movement for ice and also increase in earth temperature is a big problem. On the other hand, if the shields undergo damage wastes spread in a vast area.

Burial in North Pole is done in two ways:

Gradual penetration in ice

Some deep wells are dig in ice and reservoirs are put into them, the ice around the reservoirs are melt and reservoirs start to go down and settle at the bottom of ice. The reservoirs go 3 to 4.5 km where they hit rock beds and stop.

Using wiry cables

Reservoirs are put in holes with a specified height by cables so that the connection with reservoirs is held. So, a complete protection takes place through ice layers and wastes are buried in a known place and they can be controlled. Temperature decrease is one of the advantages of this method. Burying wastes under the oceans and sending them to space are other methods that fortunately are prohibited now.

In another method wastes are put in a reservoir under the ground which is dig among a cairn. This cairn must be a final dam against leakage so that any possibility of a crack in the system is decreased to a minimum. It's less probable that to reserve these wastes neutral metals like gold or platinum which have a high resistance to depreciation are used, so to ensure the protection via other metals that undergo depreciation some steps should be taken. Nowadays this method is being used some European countries specially Germany.

Throwing wastes into seas is also considered because it's assumed that finally due to sub duction this wastes will go under the surface. Although in Pakistan

this method is being used, we cannot be sure that through time these wastes won't go any further because our information about these areas is not enough.
Other method which is being used is throwing wastes to space. Radiant materials are placed in a missile and lunched to space, so that the danger is clear.

This method is very expensive and dangerous if the missile explodes while taking off it will be a disaster.

2-8 Best methods in some countries

The best method which is being used by countries like America, Britain and France is reserving these wastes in stone reservoirs. In this method, wastes are kept in a reservoir on the ground which makes it easier to reach and control the waste. Although this method needs a good care, in comparison with other methods it's more reliable. According to EPA's (environment protection agency) regulations areas which are used to remove wastes must be able to quarantine and keep away wastes for 10 thousand years, because this is the period in which wastes are still dangerous, for instance American congress has chosen Yoka Mountains in Nevada as the best place to bury the wastes. However, Texas and Washington have some places to bury the wastes too.

Conclusion

The area for removing nuclear wastes is studied for many years, and now the attention is toward removing them in stones where they came from first not oceans and ice lands of Poles. Stone reservoirs are better because they have a better chance to stay untouched for thousands of years and so wastes are insulated and the radiation will go back to a normal level. These stone reservoirs must have little holes and breathing spaces and they must be far away from earthquakes or natural disasters. Studies on UraniumRachlo reservoirs in Gabon shoe that this place is a good place for this purpose. The ratio of U 235 to the amount of Cans a Rachlo is much more less than normal Uranium. The reason probably is that nearly 2 billion years ago when it still was in a high depth, natural reactions of gap happened and used U 235. A big amount of Plutonium in wastes produced in America's defense department is recycled. However, America and Canada still keep their wastes, from business reactors, in water reservoirs, waiting for further decision about final removal, how to and where. In France some Silicate glasses are used to remove wastes. In Sweden wastes are kept in copper barrels because ancient handcrafts stayed intact for thousands of years in copper covers, although there's a possibility that in the future societies without mineral resources will attend to use copper and it would dangerous.

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Investigating the Relationship between Knowledge Management Processes and Organizational Culture

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Abstract: This paper explores the relationship between organisational knowledge organisational culture in the civil industries in Iran.Today,the key global pressure on management practices is knowledge identification, creation, innovation, dissemination, and development of talent. Workforce diversity in globalized business reflects knowledge management practices. Keeping in view the theoretical and empirical importance, the present study investigates the predicting role of culture attributes (Collaboration, Formalization, Trust and Learning)with reference to knowledge management practices . The population of the research consists of 950 people of managers of the companies of civil industries in Iran. A sample of 295 subjects was selected as statistical sampling. They were administered questionnaires including Organizational culture scale (OCS) and Knowledge Management Practices Scale (KMPS). Multiple regression analysis results revealed that There is a significant relationship between Knowledge Management and organizational culture in the civil industries in Iran.
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Key Words: Knowledge Management, Organizational culture, Formalization, Trust, Organizational learning.

1. INTRODUCTION

Knowledge has long been understood as a key element in establishing competitive advantage (Nonaka, 1994; Davenport and Prusak, 1997). Organizations are built not only on a foundation of exchanging information, but on creating, sharing, integrating and applying knowledge (Kogut and Zander, 1996; Adenfelt and Lagerstrom, 2006).

Knowledge Management has emerged as one of the most important area in management practices and established as a basic resource for firms and economies. Knowledge management is regarded as collection, distribution and efficient use of knowledge resources. It is a process of knowledge creation,validation, presentation, distribution and evaluation. Knowledge management according to Bounfour (2003) is a set of procedures, infrastructures and technical and managerial tools, designed towards creating, sharing, leveraging information and knowledge within and across organizations[5] .Knowledge Management is a systematic and integrative process of coordinating organization wide activities of acquiring, creating, storing, sharing, diffusing and deploying knowledge by individuals and groups, in pursuit of organizational goals.

Knowledge Management is a multi dimensional construct with a large number of interrelated attributes. However, its three components or attributes that are commonly found in the literature are: knowledge acquisition or adaptation, knowledge dissemination or sharing and responsiveness to knowledge or knowledge use The knowledge management practices in the organizations depend on some prerequisites. One of the important pre-condition for effective knowledge management is organizational culture. Organizations do not operate in a social vacuum but are influenced by the socio-cultural context (Hofstede, 2001), hence, the organizational culture has also been considered as form of organizational capital (Camerer & Versalainen, 1998). Organizational culture consisting of behavior, action, and values that people in an organization is expected to share and follow. Organizational culture as a concept is also considered to be key element in managing organizational change and renewal, a sort of glue that bonds the social structure of an organization together. Knowledge management is a rather a new phenomenon and is in the initial stages of its exploration. In order to develop new knowledge and use the knowledge which already exists within organizations, it seems essential to create an atmosphere of trust and security to encourage innovation experimentation and risk taking (Lopez et al., 2004). Although, some of the large multinational firms local institutions, development sector organizations, public and private departments and the financial institutions are working on knowledge management, still the concept is localized to a few information system wizards within these organizations (Khilji, 2001). There is a lack of empirical evidence about what are the

specific cultural variables that support knowledge management processes and help in development of knowledge culture (Oliver & Kandadi, 2006). Objective of this study is to evaluate relationship between organisational knowledge organisational culture in the civil industries in Iran.

1-1.LITERATURE REVIEW

Standards Australia (2003) defines knowledge managements as, "The design, review and implementation of both social and technological processes to improve the application of knowledge, in the collective interest of stake holders". Nonaka (2007) prefers to call knowledge management as Knowledge-Based Management, connecting people to people and people to information to create competitive advantage. Knowledge management is a human resource management exercise than a technology based discipline. It is not merely state of the art technology used to improve efficiency of the knowledge. Rather it is an exercise about how people can be motivated, best utilize their knowledge, experiences and enhance the creativity by using state of the art.

Number of researchers, on knowledge management has focused on specific processes and activities within knowledge management. Lee, Lee and Knag, (2005) introduced the Knowledge Circulation Process that can be determined by knowledge creation, knowledge accumulation, knowledge sharing, knowledge utilization and knowledge internalization . Researchers like (Thomas,et al, 2001) have discussed four critical stages of management of a firms knowledge. These include knowledge creation and acquisition, knowledge transfer, interpretation of the knowledge to serve organization goals, and application of knowledge to achieve organizational goals. Darroch (2003) has elicited knowledge creation and acquisition, knowledge dissemination and responsiveness to knowledge as main components of knowledge management practice (Darroch, 2003)

Knowledge creation deals with a variety of knowledge, whether tacit or explicit and is accelerated by encouraging synergistic interrelations of individuals from diverse back grounds" (Lee et al., 2003).Nonaka (1994) cites dynamic organizations as the ones that not only process information but also create information and knowledge. Through interaction with environments, organizations absorb information, convert these into knowledge and combine it with their experience, values and rules. Nonaka, postulates that organizational knowledge creation can be viewed as an upward spiral process, starting at the individual level moving up to the collective (group) level and then to the organizational level, sometimes reaching out to the inter-organizational level.

The culture of an organisation influences the way in which practitioners learn and share knowledge . Workforce diversity in globalized business reflects a multitude of cultural and ethnic backgrounds, shared values that blur potentially sharp cultural differences. The cultural differences from country to country necessitate aligning corresponding differences in management practices. Resultantly, the success or failure of knowledge management within organizations depends on 'culture', an emerging pre-requisite for effective knowledge management.

Deshpande and Webster (1989) define organizational culture as the set of shared values that help organizational members understand organizational functioning and thus guide their thinking and behavior. Researchers argued that culture is a complex system of norms and values that is shaped over time and affects the types and variance of organizational processes and behaviors (Barney, 1986). Organizational culture as a concept is considered to be a key element of managing organizational change and renewal (Pettigrew, 1990). Thus, culture is a sort of glue that bonds the social structure of an organization together. Hofstede, (1991) called culture the "Software of the mind".In the competitive environment the organizations have to change its culture in order to survive otherwise, it may be even counterproductive (Jex, 2003). Four types of culture are found in organizations i.e. power culture, role culture, support culture and achievement culture (McKenna, 2000).

1-2.Organizational culture Dimensions

Alavi, Kayworth & Leidner (2005) cite expertise, formalization, innovativeness, collaboration and autonomy as the values of organizational culture that lead to effective knowledge management (Alavi et al,2006).

The current study, focus on trust, collaboration, learning and formalization, as cultural factors of knowledge creation process.

1-Formalization

In work setup formalization refers to rules, procedure and written documentation such as policy manuals and job descriptions (Daft, 2001). Graham and Pizzo (1996) argued that effective knowledge management requires a balance between open and flexible organization system along with formality and discipline to ensure tangible output. The study, contend that structured and standardized procedures are needed to capture, control and connect knowledge. Although, a

general belief that formalization inhibits creativity and innovation and thus knowledge management. However, the empirical evidences do not support the concept, as more innovation and creativity have been found in more formalized setups (Lee & Choi, 2003, Zaman, 2006).

2-Trust

Trust is the most important explicitly stated value essential for knowledge management. Lopez et al. (2004) stress that an atmosphere of trust and security is essential to encourage innovation, experimentation and risk taking in order to develop new knowledge and use existing knowledge. Trust has been defined as an expectation that arises within a community of regular, honest and cooperative behavior, based on commonly shared norms, on the part of other members of that community (Fukuyama, 1996).

3-Learning

Organizational learning is synonymous to capacity to innovate and related to the ability to apply knowledge in organizations (Sinkula, 1994). A learning process relating to use of conceptual knowledge enhances the employees' knowledge applicative capability (Tsai & Lee, 2006). A learning culture opens up formal and informal channels of communication (Bhatt, 2000). Learning is found to be a predictor of knowledge creation (Lee and Choi, 2003). Bhatt (2000) relates individual learning capability and organizational learning culture to broadening of knowledge base. Strong learning culture of firms is linked to creation, acquisition, and transfer of knowledge (Murray and Donegan, 2003).

4-Collaboration

Collaboration is the degree of active support and help in the organization. Collaboration is defined as human behavior sharing of meaning and completion of activities with respect to a mutually shared goal and taking place in a particular social or work setting (Sonnenwald & Pierce, 2000) .

Delong and Fahey (2000) cited interactivity, collaboration, sharing and teaching, dealing with mistakes, orientation to existing knowledge as the cultural characteristics, shaping social interaction in the context of knowledge management. Lopez et al., (2004) empirically identify collaborative culture as a means to leverage knowledge through organizational learning. A culture of collaboration helps in knowledge creation by increasing knowledge exchange.

Hypothesis 1

There is a positive relationship between Knowledge Management (KM) with culture Organizational dimensions.

Hypotheses 2

2-1- There is a positive relationship between KM and Formalization.

2- 2- There is a positive relationship between KM and Trust.

2- 3- There is a positive relationship between KM and Learning.

2- 4- There is a positive relationship between KM and Collaboration

2.Materials and Methods

This study is an investigation and correlational research. The population of the research consists of 950 people of managers of the companies of Civil industries in Iran. A sample of 295 subjects was selected as statistical sampling.

Organizational culture scale (OCS) measured the four attributes of organizational culture. The OCS in current study consists of 13-items; 4 for Collaboration, 3 each for Learning, Trust and Formalization. The scale was rated on 7 -point Likert -type scale, with 7 indicating "Strongly Agree" to 1 indicating "Strongly Disagree". The test for alpha reliability was .86 for the current instrument.

The Knowledge Management Process Scale was adapted to measure knowledge management process by Lee et al.(2005. This version consisted of 29-items questionnaire that measure the five dimensions of Knowledge Management Processes, however in the present study 5 items measuring the Knowledge Management was used. The items were rated on a 7 point Likert's type scale, ranging from

(1), Strongly Disagree to (7) Strongly Agree. Based on table (1) and table (2), the internal consistency reliability estimates for the knowledge management dimension was 0.89 and the Organizational culture was .86. According to Pearson correlation test, correlation is significant which are indicated in tables (3) and (4). Thus, null hypothesis can be rejected. The reason is that Sig. is lower than 0.05.

Table 1. Variables' reliability statistics

Variables	Cronbach's Alpha
knowledge management	0.89
Organizational culture	0.86

Table 2. Organizational culture Variables reliability statistics

Variables	Cronbach's Alpha
Trust	0.84
Collaboration	0.85
Learning	0.87
Formalization	0.86

3.**Results**

Correlation Test of all variables along with alpha coefficient values calculated in order to establish the validity and reliabilities of the instruments, shown in Table 3.

According to the Pearson correlation test (table3), null hypothesis cannot be rejected. It means that the existence of a significant relationship between KM process and organizational culture in companies is at 0.95 degree of confidence. As it illustrated in table (3),(4) the relationship between KM and every dimension of organizational culture is significant for "Trust", "Formalization " and " Learning "and "Collaboration".

Table 3. Pearson Correlation between KM and Organizational culture

	Organizational culture	
Knowledge Management	0.561	Pearson correlation
	0.046	Sig. (2-tailed)

Table 4. Pearson correlation test of Variables

Independent Variables	*Dependent Variables*	*N*	*Sig*	*Result*
Constant	*KM*	*295*	*.000*	*Not Rejected*
Trust	*KM*	*295*	*.000*	*Not Rejected*
Collaboration	*KM*	*295*	*.000*	*Not Rejected*
Learning	*KM*	*295*	*.120*	*Not Rejected*
Formalization	*KM*	*295*	*.000*	*Not Rejected*

In order to verify the direct/predicting effect of organizational culture attributes (Trust, Collaboration, Learning and Formalization) on knowledge management process, multiple regression was computed and has showon in Table 5, the value of $R2$ explains 23.5% of the variance in the scores for knowledge management accounted for by the cultural dimensions.

The regression results partially support the hypothesis, as significant contribution to the knowledge management is made by trust, collaboration, formalization, and learning has shown significant impact.

Table 5. Result of Multiple Regression Analyses for Trust, Collaboration, Learning and Formalization on KM

Variables	***B***	***SE***	***ß***	***t***	***p***
Constant	***13.06***	***.80***		***18..89***	***.000***
Trust	***.17***	***.05***	***.14***	***3.63***	***.000***
Collaboration	*.24*	*.04*	*.22*	*6.01*	*.000*
Learning	*.08*	*.04*	*.06*	*1.54*	*.120*
Formalization	*.30*	*.05*	*.25*	*6.36*	*.000*

*Df =(4,294), R2 = .270, *p <.001*

4.Discussions

The research findings confirmed the similar research. There is a significant relationship between Km process and organizational Culture dimensions. Collaborative culture affects knowledge creation through increasing knowledge exchange (Nahapiet & Ghoshal, 1998), as the exchange in knowledge among different members is a prerequisite for knowledge creation. The collaborative culture fosters this type of exchange by reducing fear and increasing openness among members (Lee & Choi, 2003). The findings are in line with Zucker et al. (1996) that the significance of collaborative culture on knowledge creation in biotechnology industry and Lee and Choi (2003) who found a positive relationship between collaborative culture and knowledge creation in a Korean Stock Exchange Trust facilitates open, substantive and influential knowledge exchange. When trust is high, the individuals are more prone to participate in knowledge exchange, resulting in knowledge creation (Nahapiet & Ghoshal, 1998). Again, the findings are in line with Lee and Choi. Learning is the acquisition of new knowledge by the individuals who are able and willing to apply it in decision making or influencing other. According to Saeed,et al. (2010) a deeply ingrained learning culture is a precondition for successful knowledge creation.

Although, knowledge management requires flexibility and less emphasis on work rules and lack of formal structure, tends to enable individuals within an organization to communicate and interact with one another. But effective knowledge management requires a balance between open and flexible organization system along with formality and discipline to ensure tangible outputs (Ichigo et al., 1998). The structured and standardized

procedures are needed to capture, control and connect knowledge.

Furthermore, the formal rules enable organizational learning and knowledge and enhancing the effectiveness of organizational communication (Keiser, et al., 2001). Rules and directives help sequencing problem solving and decision making, which in turn facilitate knowledge accumulation too. Empirical literature also supports the results contending that a more innovation and creativity have been found in more formalized setups (Lee & Choi, 2003, Zaman, 2006).

Implication

The findings of the research help knowledge management researchers as well as practitioners develop a better understanding of the role of organizational culture and successful implementation of knowledge management process. Management, while designing and developing strategies and policies and training manuals, the current study may provide necessary guidelines to understand the issues of knowledge management and culture.in this study,we use the effect of Organizational culture dimensions on knowledge management but using other organizational factors such as technologhy or strategy that can be effect on KM for analysis can be done in future studies.

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