

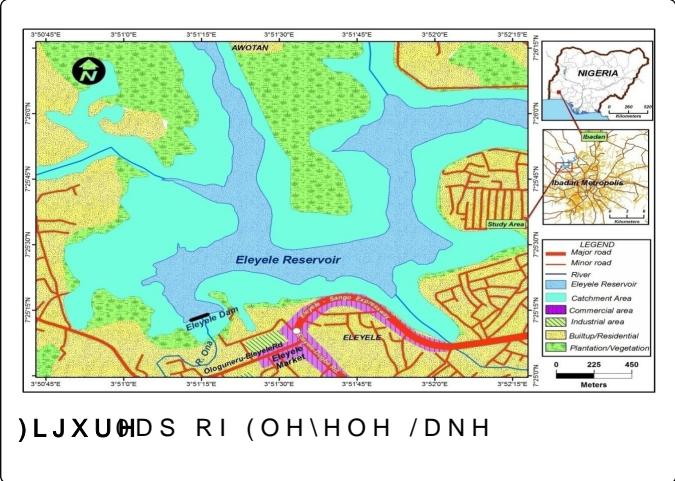
* URZWK 3DWWHUQV DQG \$RSHQ DFFHVV (OH\HOH /DNH 6RXWKZHVW 1LJHULD

.DUHHP 2.20DQUHZDMXKRI (ZULVDVRODQ2\$NLQWXQGH 0\$
'HSDUWPHQW RI \$TXDFXOWXUH DQG)LVKHULHV 0DQDJHPPHQW 8QLYHUVLW\ RI ,EDGDQ 1LJHULD
)HGHUDO &ROOHJH RI)UHVKZDWHU)LVKHULHV 7HFKQRORJ\ 30% 0DLGXJXUL 1LJHULD
'HSDUWPHQW RI :LOGOLIH DQG)LVKHULHV 0DQDJHPPHQW 2VXQ 6WDWH 8QLYHUVLW\ 1LJHULD
1DWLRQDO 8QLYHUVLW\ RI /HVRWKR 'HSDUWPHQW RI \$JULFXOWXUH 5RPD .LQJGRP RI /HVRWKR 6RXV
&RUUHVSROGLQDDXWRRJ. 'HSDUWPHQW RI \$TXDFXOWXUH DQG)LVKHULHV 0DQDJHPPHQW 8QLYHUVLW\
ND\NDJ #\DKRR FR XN
5HFHLYHG GD\H \$FFHSWHG GD\OH 3XEOLVKHG GDXW\WV
&RSULJKW .DUHHP 2. HW DO 7KLW LV DQ RSHQ DFFHVV DUWLFOH GLVWULEXWHG XQGHU WKH WHUP RI
XVH GLVWULEXWLRQ DQG UHSURGXFWRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXU

\$EVWUDFW
+HSVHWXVVRGRFRPPHUFLLDOO\ YDOXDEOH ILVK DQG LV FRQVLGHUHG DV HQGHPLF V
FRQGLWLRQ+HDFWIRORRURP /DNH (OH\HOH 2\R 6WDWH ZHUH LQYHVWLJDWHG DV D
HVVHQWLDO IRU EULQJLQJ LW WR FXOWXUH \$ 7RWDO RI VSHFLPHQV DQG
FROOHFWHG EHWZHHQ -XQH DQG \$XJXVW 7KH PRUSKRPHWULF LQGLFHV
/HQJWK 6/ %RG\ :HLJKW %: DQG 6WRPDFK :HLJKW 6: ZHUH DVVHVHG XVLQJ
OHQJWK ZHLJKW UHODVLRQ & ROLGLWLRQ IDZHUHU FDOFXODWHG 6H\ UDWR RI 0D
)HPDOHV ZDV REWDLQH G ZKLFK VKRZV D IHPDOH GRPLQDWHG SRSDO WLRQ 7KH
%: UDQJHG IURP FP DQG J UHVSHFWLYHO\ /HQJWK ZHLJKW U
FDOFXODWHG DV
/RJ %: ORJ 6/ U
7KLW DQDO\VLV VKRZH G VLJQLILFDQW UHODWLRQV KLS EHWZHHQ WKH VWDQGDUG
UHODWLYH FRQGLWLRQ IDFWRU .Q FDOFXODWHG UDQJHG IURP ZKLOH WK
IDFWRU IDOO ZLWKLQ WKH UDQJH UHFRPPHQGHG IRU IUHVKZDWHU ILVK VSHFLHV L
WKH ILVK IROORZV FXEH ODZ DQG H\KLELWHG SRVLWLYH DOORPHWU JURZWK 7KL
PDQDJHPPHQW DQG JXLGH IRU IXWXUH FXOWXUH WULDOV

.H\ZRUG\H SV\HVRV\HQJWK ZHLJKW UHODWLRQV FRPPHUV\1LJHULD SULQFLSD
&RQGLWLRQ IDFWRU (OH\HOH /DNH \H DU URDGRGDMLDMMKGRQRPLF DQG QX
YDOXH > @ \$ PHGLXP VL]H \$IULFDQ SLNH
,QWURGXFWRQ IDW FDUERK\GUDYHUBQG DVK w\W > @
VSHFLHV SUHIHUV TXLHW DQG GHHS ZDWH
(OH\HOH 0DQLDQD FRQVWUXFWHG KLOHQJWK XSDUWNJ+LQJGRP WJGLSDQW RI
FRQVXPSWLRQ DQG FRQVHUYDWLRQ LQFRPPHUV\ZDWHU FDOFXODWHG \$OVRXUJ /DNH
TXHVW WR FUHDWH D PRGHUQ ZDWHU V\SRVHQV\HBRWR\HFRV\WKH\FKSDQLHJUR
ZDWHU VFDUFLW\ IRU WKH HPHUJLQJ ,EDGDQ PHWURSROLY OHG WR WKH
FRQVWUXFWLRQ RI (OH\HOH 'DP RQ WKH PDYXG\RU 9DQJWK ZHLJKW UHODWLRQ
VWRUDJH FDSDFLW\ RIH ODNL\0LSRQDHO\QV\HVR\HFRV\WKH\FKSDQLHJUR
DQG UDLQ\ VHDVROV W\SLFDO RI WURS\FFD\HQYLR\PHQW \$GHE\YDOXDEOH\QV\
IDPLOLHV OLNH &LFKOLGDH &KDQQ\GDH WKH\KOLY\HODLW\FDQ\DOYR\SRYLGH\LPSP
+HSVHWLGDH &ODULLGDH 2VWHRJORV\EGDH\HFW\HFRV\WKH\FKSDQLHJUR
ODNH > @ \$PRQJ W\KSH\HFRV\HFRV\WKH\FKSDQLHJUR
}VK\SHFLHV RI}R\PHV\HFRV\WKH\FKSDQLHJUR
DGHTXDWHO\ VWXGLHG
FRQGLWLRQ+HDFWIRORRURP /DNH (OH\HOH 2\R 6WDWH ZHUH LQYHVWLJDWHG DV D
HVVHQWLDO IRU EULQJLQJ LW WR FXOWXUH \$ 7RWDO RI VSHFLPHQV DQG
FROOHFWHG EHWZHHQ -XQH DQG \$XJXVW 7KH PRUSKRPHWULF LQGLFHV
/HQJWK 6/ %RG\ :HLJKW %: DQG 6WRPDFK :HLJKW 6: ZHUH DVVHVHG XVLQJ
OHQJWK ZHLJKW UHODVLRQ & ROLGLWLRQ IDZHUHU FDOFXODWHG 6H\ UDWR RI 0D
)HPDOHV ZDV REWDLQH G ZKLFK VKRZV D IHPDOH GRPLQDWHG SRSDO WLRQ 7KH
%: UDQJHG IURP FP DQG J UHVSHFWLYHO\ /HQJWK ZHLJKW U
FDOFXODWHG DV
/RJ %: ORJ 6/ U
7KLW DQDO\VLV VKRZH G VLJQLILFDQW UHODWLRQV KLS EHWZHHQ WKH VWDQGDUG
UHODWLYH FRQGLWLRQ IDFWRU .Q FDOFXODWHG UDQJHG IURP ZKLOH WK
IDFWRU IDOO ZLWKLQ WKH UDQJH UHFRPPHQGHG IRU IUHVKZDWHU ILVK VSHFLHV L
WKH ILVK IROORZV FXEH ODZ DQG H\KLELWHG SRVLWLYH DOORPHWU JURZWK 7KL
PDQDJHPPHQW DQG JXLGH IRU IXWXUH FXOWXUH WULDOV
+ RGRFRK FRPPRQO\ NQRZQ DVH\SRV\HFRV\WKH\FKSDQLHJUR
VROH UHSUHVHQWDWLYH RI WSKH\HFRV\WKH\FKSDQLHJUR
GLVWULEXWHG DURXQG :HVWUHQ DQG &HFWLDO\HFRV\WKH\FKSDQLHJUR
VKDOORZ ZDWHUV RI ULYHUV LQ WKH SODLQV DV ZHOO DV HVWXDULHV DQG D YD
RI RWKHU IUHVKZDWHU KIDV\HFRV\WKH\FKSDQLHJUR
VSHFLHV R\K\HFRV\WKH\FKSDQLHJUR
IHHG SULDULO\ RQ FLFKOL\HFRV\WKH\FKSDQLHJUR
KLJKO\ SULFHG)UHV\HFRV\WKH\FKSDQLHJUR
LVKHULHV DQG \$TXDFXOWXUH - R XU
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DERYH VHD OHYHO DQG VXUURXQGHG E\ TXDUWILJGJH KLOOV WRZDUG WKH
 GRZQVWUHP VHFWRQ ZKHUH WKH GDPHEDUUDJH LV ORFDWHG \$ QXPEHU RI
 VWUHP FKDQQHOV VHUH DV IHGLQJ UHFKDUJHLOVWUHPV WR WKH OH
 ZHWODQGHEDNLQ KDV D VXUIDZLWKDDPHDQ NP
 GHSWK RIH ZLHVW DQG QDUURZHVW DUPRI WKH ODNH LV "DERXW
 P DQG P UHVSHFWLYHO\ KDYLQJ IRUHHVHUHUYH ZLWK PFK YHJHWDWLRQ
 VWUHWFK RQ HDFK VLGH (RZLWK WKH ZDWHU XDOO
 OHYHO ULVLQJ GXULQJ HDUO\ SHULRG RI 6DQVWVHDVQ ,W FRYHUV VRPH SDUWV
 ,MRNRGR \$SHW \$ZRWDQ 2ORJXQ HUX \$JEDMH ,GL RVDQ 3RO\WHFKQLF RI
 ,EDGDQ DQG (OH\HOH) VUHERZLWKHLEOHWK ZHLJKW UHODWLRQV KLS RI +H
 GRPLQDWHG E\ ,ODMH DQG <RUXEDV +ZPHDQVWRWPHOH WKH DWDGLDQXGH
 }VKLQDUPLQJ DJUR SUWHDYFLQJ DQG ERDW



)LJXUHS RI (OH\HOH /DNH

,Q FDVH RI IHPDOHV WKH 7/ DQG %: ZHUH
 DQG WR J UHPSHQWLYRIOPDOH ZDV F
 s FP DQG WKH PHDQ %: FDOFXODWH
 IHPDOH WKH PHDQ 7/ DQG %: ZHUH FDOFX
 s J 1 UHVSHFWLYHO\ \$OVR W
 WKH VSHFLHV DUH ODOHV s FP)H
 &RPELQHG VH[HSOHQJWK ZHLJKW UHODW
 VDPS)H[SUHVVG E\ WKH UHJUHVLRQ

'% L ætärws E uäšrlwraä

/RJ OHQJWK DJDLQVW ORJ ZHLJKW UHYHD
 WKHUH LV D GLUHFV SURSRUWLRQDOLW\ EH

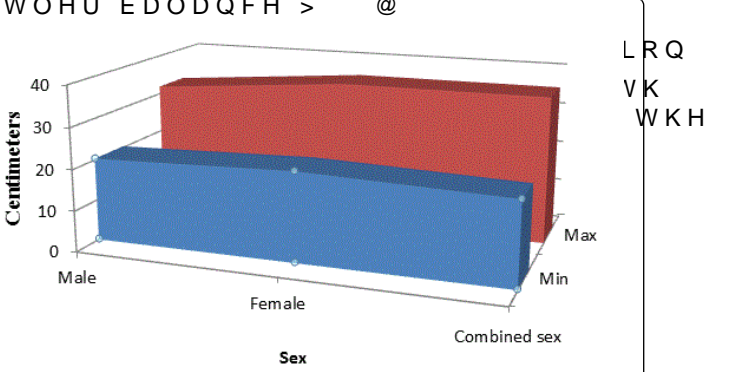
6H[Q	6WDQGDUG OHQJWK WR PDK ZHLJKW J			
		0LQ 0D[0HDQ "	6'0LQ 0D[0HDQ " 6'
0DOHV			"		"
			"		"

&ROOHFWLRQ RI VDPSOH

6DPSOHV RI WKH VWXG\ ZHUH FROOHFWHG IRUWQLJKWO\ GXULQJ
 -XQH WR \$XJXVW IURP 6DQVWVHDVQ DQG E\ DUWLVDQDO
 XVLQJ EDLWV DQG VJLOGLVWUHP VLJHV 7ZR
 KXGUHV DQG VSHFLPHQV RI UH VDPSONG ZLWK
 OHQJWK DQG ZHLJKW UDQJLQJ IURP 7DEOH 1 WKH VSHFLPHQV ZHUH PDOHV DQG
 UHVSHFWLYHO\ 2I WKH WRWDO QXPEHU RI VSHFLPHQV 6'6WDQGDUG 'HYL

ORUSKRPHWULF PHDVXUHPHQWV LQFOXGH 7RWDO /HQJWK 7/ DQG
 6WDQGDUG /HQJWK 6/ WR WKH QDUHVW 6'6WDQGDUG HURR %: WUHQJW
 WKH QDUHVW J RI HDFKDWSEFPHQWUHPDKXZHLJKW UHODWLRQV KLS ZDV FDO
 IURP WKHUH ZDV WDNHQ IURP WKH WLS RI WKH VQRXW PRXWK
 FORVHG WR WKH H[W]HODG 6VLJRP WKH VQRXW
 WKH PLG SRLQW RI J D PHDVXULQJ ERDUG ZKLOH %:
 ZDV PHDVXUH XVLQJ D WRS ORDGLQJ OHWOHU EDODQFH > @

/HQJWK ZHLJKW UHODWLRQV KLSV ZHUH
 Lf" ZKHUH : LV WKH WRWDO ZHW ZHLJ
 6/ FP DQG D DQG E DUH WKH HTXDWL
 OHDVW VTXDUHV PHWUHQJHURVW
 LVRPHWULF YDOXH RI E DQG DGRGH
 IDFWRU ZKLFK VKRZV WKH GHYILQHV
 ZDV GHWHUPLQHG E\ WKH IRUPXOD
 ZKHUH : ZHLJKW LQ J DQG
 / OHQJWK LQ FP



5HVXOWV

H OHQJWK ZHLJKW IUHTXHQF\ GLVWULGXJH RI WKH VSHFLPHQV RI IURP
 /DNH (OH\HOH LV VKRZQ LQ 7DEOH 6LQVXQO\ WKH WRWDO OHQJWK IUHTXHQF\
 RI VSHFLPHQ ZDV LOOXVNDWHZHUH)XQGHWR UDQJH
 IURP WR FP LQ WRWDO OHQJWK DQG WRWDO ZHLJKW ZDV UDQJHG
 EHWZHHQ WR J

&LWDWL RQHHP 2. 2ODQUHZDMX \$1 2VKR () 2ULVDVRQD 2 \$NLQWXQGH 0\$ +HSVHWXV RGRH
%ORFK &DSWXUHGLQ (OH\HOH /DNH 6RXVWV LJVHVLV 1LJHULD)LVK \$TXDF -

3DJH RI

H &RQGLWLRQ)DFWRU . UDQJHG EHDVH \$ODX VNRQJEHURIRXQG WKHIRU %DJH
VH[VH 7DEQH VHXOW VKRZHG WKDW WKH WKLQD QHODVH RFXVDFWLRQ VNRHMLUH
S ODUJHU WKDQ PDOHV

6H[&RQGLWLRQ IDFWRU YDOXH	
ODOHV	$\frac{\sum K}{n} = \frac{67.52}{55}$	
)HPDOHV	$\frac{\sum K}{n} = \frac{185.65}{150}$	
&RPELQHG VHX	$\frac{\sum K}{n} = \frac{253.17}{205}$	

> @ FRQGLWLRQ IDFWRU RGRH VNRHMLUH
WKDQ WKDW RI WKH VNRHMLUH WKH UHV
8JZXPED DQG ,GRZX IRU PDOH+ RGRH
(NLWL UHVHVRV DQG VNRHMLUH WKDQ IHPDOHV Z
WKDQ PDOHV GXULQF RFXVDFWLRQ VNRHMLUH
HJJ GHYHORSFHQW LQ WKH IHPDOHV DQG K

&RQFOXVLRQ

LVVWXG\ KDV PDGH DYDLODEOH LQIRUP
FRQGLWLRQ+RGRH VNRHMLUH (OH\HOH) FSDQ
UHODWLRQV ZHUH VNRHMLUH VNRHMLUH
OHQJWK DQG VWRPDFK VNRHMLUH VNRHMLUH
HYLGHQW WKDW VNRHMLUH VNRHMLUH DOORP
HV RGRH VNRHMLUH VNRHMLUH VNRHMLUH
FRQGLWLRQ RI WKH ODNH IRU FRQWLQXRXV

7DEQH RQGLWLRQ IDFWRU RI +HSVHWXV RGRH LQ /DNH (OH\HOH 1LJHULD
ZKHUH XPPDWLRQ RI FRQGLWLRQ VNRHMLUH VNRHMLUH
XVHG

'LVFXVLRQ

7LMDQ 2ODQ\$2VXOXED22MR ,PSDFW RI 8UEDQL
:HWODQG 'HJUDGDWLRQ VNRHMLUH VNRHMLUH
:HVW 1LJHULD
/HQJWK :HLJKW UHODWLRQ VNRHMLUH VNRHMLUH \$QDOVLV RI VWRPDFK VNRHMLUH
H[SORLWDWLRQ DQG PDQDJPHQW VNRHMLUH VNRHMLUH 5LYHU 1LJHULD +IGUREL
\$FFRUGLQJ WR 1DJV VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
WKH JURZWK JRQDGO GHYHORSFHQW DQG VNRHMLUH VNRHMLUH VNRHMLUH
SRSXODWLRQ > @ ,Q WKH SUHVHQRV VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
VWDQGDUG OHQJWK 6/ DQG VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
VLJQLVNDQFH S VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
RI ZDV REWDLQHG DV D UHODWLRQV VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
DQG WKH VWRPDFK ZHLJKW VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
VWDQGDUG VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
/LNHZLVH VWRPDFK ZHLJKW LQFUHDVH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
LQFUHDVH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
LQGLFDWHG E VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
WR VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
LQ +HSVHWXV RGRH LQ 2JERPRV VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
RGRH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
1LJHULD ZLWK SRVLWLYH DOORPHWLF VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
/HQJWK ZHLJKW VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
WKDW RI RWKHU VSHFLHV LQ 1LJHULD ZDWHU ERGLHV 1LJHULD (NHQHXV DQG
6DPXHO UHFRUG VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
GRFXPHQW VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
\$IRDGH DQG ,NXODOD IRXQG IRU &K VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
(OH\HOH /DNH > @ +RZHYHU \$IRDGH DQG ,NXODOD UHSRUWHG QHJDWLYH
DOORPHWLF JURZWK SDWWHUQV IRU 6DURWKHURGR VNRHMLUH VNRHMLUH VNRHMLUH
+HPLFKURPLV ELPDFXODWXV LQ (OH\HOH /DNH VNRHMLUH VNRHMLUH VNRHMLUH
%DJHQDO RSVNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
WHUP RI IRRG DYDLODELOLW\ DQG JRRG VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
IDVWHU ZLWK VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
REWDLQHG VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
ZLWK VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
FRQGLWLRQ IDFWRU VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
UHVHUYRLU DQG 5LYHU =DPEH]L UHVSHFWLYHO VNRHMLUH VNRHMLUH VNRHMLUH
D PHDQ FRQGLWLRQ VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
&RPSDULQJ . YDOXHV LQ WKLV VWXG\ ZLWK VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
WKDW WKLV YDOXH YDULHV IURP ! WR VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
DIULFDQD LQ 1NRUR 5LYHU VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH VNRHMLUH
IRU

&LWDWLBQHP 2. 2ODQUHZDMX \$1 2VKR () 2ULVDVRQD 2 DQG \$NLQWXQGH 0\$ HSHVHWXKZVCR
%ORFK &DSWXUHG LQ (OH\HOH /DNH 6RXWGLVHW 1LJHULD)LVK \$TXDF -

3DJH RI

(NHOHPX6DPXHO \$\$= *URZWK 3DWWHUQV\$ERZHE RQGLW &RQ DFWLRQV)DFWRU /HQJWK
RI)RXU 'RPLQDQW)LVK DSWXUHG LQ (OH\HOH /DNH 6RXWGLVHW 1LJHULD)LVK \$TXDF -
%HUQDULQNRQ\$NDQGH\$GH\HFL\$DDO&VL .DOX .0 8PHKDP 61 2NHUHH) /HQJWK
2UJDQROHSWLF FKDUDFWHULVWLFV /HQJWK ZHLJKW UHODWLRQV KLS PQC ERQGLWLRQ
IDFWRU RI 2UHRFKURPLV QLORWLFXV LQ (JDK 6RXWGLVHW 1LJHULD)LVK \$TXDF -
1LJHULD ,QWHUQHW -RXUQDO RI)RRG 6DIHW\
\$IRD\$N,NXO\$D2D /HQJWK :HLJKW 5HODWLRQV KLS PQC ERQGLWLRQV 6* /HQJWK :HLJKW
)DFWRU DQG 6WRPDFKHPLFQW RFDVFXDWX DQG &RQGLWLRQV KLS PQC ERQGLWLRQV
6DURWKH RFDVFXDWX RPLGRWLRQV KLS PQC ERQGLWLRQV -RXUQDO RI \$QLPDO DQG 3ODQW 6F
3HUFLI RUPKOL (DHLV DHR XWKZH VJHUL DLRSHY \$IRD\$ /HQJWK ZHLJKW UHODWLRQV KLS
7URS /DEHR RJXQHQLV %RXOHQJHU LQ \$VH
%DJHQO 0HWKRGV IRU VSRGXFWQRQLQ LVK \$TXD 6FL
IUHVKZDWHU HG %DFLHQW DFLDNL RHOSS
%DORJXQ H ELRORJLFDVFXDWX DRRRQ 0 VF
HVLQQLYHUVLW\ RI /DJRV /DJRV