



- RXUQDO RI & KLOG % HKDYL

\$ GROHVFHQW

\$YL , WJKDN HW DO - & KLOG \$GROHVFHQW
'2,

5HVHDUFK \$UWLFOH

2SHQ \$

5FTUJOH UIF \$SPTT \$VMUVSBM \$MJOJDBM 6UJM
*TSBFMJ BOE "NFSJDBO 5ZQJDMMZ %FWFMPQ

TDPDUD \$YL , WJKDN 5 2EFDWLU 0 \$ECDWOD KQJHΦ Q&JHURPL - RVPDQ
'HSDUWPHQW RI 2FFXSDWLRQDO 7KHUDS\ <RUN & ROOHJH 7KH & LW\ 8QLYHUVLW\ RI 1HZ <RUN *X\ 5
'HSDUWPHQW RI 2FFXSDWLRQDO 7KHUDS\ /RQJ , VODQG 8QLYHUVLW\ %URRNO\Q %URRNO\Q 1HZ <RUN 8
'HSDUWPHQW RI 3V\FKRORJ\ & KLOG & HQWHU \$O 4XGHV 8QLYHUVLW\ -HUXVDOHP , VUDHO
'HSDUWPHQW RI 2FFXSDWLRQDO 7KHUDS\ -RLQW SURJUDP)DFXOW\ RI 6RFLDO :HOIDUH +HDOWK 6FLHQ
& RUUHVSRLQGLQJDBWKRQ\ , WJKDN \$VVRFLDWH 3URJUDP 'LUHFWRU \$VVRFLDWH 3URIHVVRU 'HSDUWPHQ
1HZ <RUN *X\ 5 %UHZHU %/9' -DPDLFD 1HZ <RUN 86\$ 7HO)D[(PDLO WD
5FHFLYHG OODWFK \$FFHSODNG GDWH3XEOLVKHG GDWH 0D\
& RS\ULJKW < \$YL , WJKDN 7 HW DO 7KLV LV DQ RSHQ DFFHVV DUWLFOH GLVWULEXWHG XQGHU WKH W
XVH GLVWULEXWLRQ DQG UHSURGXFWLRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXL

\$EVWUDFW

3XUSR\RI DVVHVV WKH FURVV FXOWXUDO FOLQLFDO XWLOLW\ RI WKH 9LVXDO 0
QRUPV IRU W\SLFDOO\ GHYHORSLSQJ 3DOHVWLQLDQ , VUDHOL DQG \$PHULFDQ N
FRPSDULVRQV WHVWHG WKH H[WHQW WR ZKLFK WKH 90, VWDQGDUGL]HG 8 6 QRUP
XVH ZLWK WKH DIRUHPHQWLQRHG JURXSV ZLWKRXW WKH QHHG IRU FURVV FXOWXU
WHVW VHQLWLW\ DQG VSHFLILFLW\ VXFK WKDW VWXG\ FODVVLILFDWLRQ UHVXO
8 6 QRUPV

0HWKR\WVH VDPSOH ZDV FRPSULVHG RI W\SLFDOO\ GHYHORSLSQJ NLQGHUJDUW
PHDQ SHUIRUPDQFH VFRUHV ZHUH QRW VLJQLILFDQWO\ GLIHHUHQW IURP WKH SXE
3DOHVWLQLDQ JURXS DQG VLJQLILFDQWO\ KLJKHU IRU WKH , VUDHOL JURXS RQ D
ZHUH KLJKHU RQ WKH 9LVXDO 0RWRU , QWHJUDWLRQ DQG 9LVXDO 3HUFHSWLRQ WH
7KH VHQLWLW\ UDWHV IRU HLJKW RI WKH QLQH FDOFXODWLRQV UHVXOWHG LQ
UHVXOWV DQG WKH 90, VWDQGDUGL]HG FODVVLILFDWLRQ RI WUXH SRVLWLYH FDVH
GHPRQVWUDWHG SHUIHFV DJUHHPHQW EHWZHQB WKH VWXG\ FODVVLILFDWLRQ UHV
VSHFLILFLW\ UDWHV REWDLQHG IRU WKH , VUDHOL DQG \$PHULFDQ JURXSV ZHUH PR

& RQFOXV\RE\H H[SORUDWRU\ ILQGLQJV PHULW DGGWLRQDO UHVHDUFK WR IX
HPSOR\LQJ WKH 90, 8 6 QRUPV ZLWK RU ZLWKRXW FURVV FXOWXUDO DGDSDWDWL
JURXSV

.H\ZRUG\B VV FX\W\H\W\QGDUDQGDQ\B\GV\W\H\W\QGDQ\ PRWRU LQWHJUDWLRQ LV WKH
DJUHHPHQW SHUFHSWLRQ DQG PRWRU VNLOOV > @
VNLOOV LV LPSRUWDQW LQ DQG RI LWV
GHYHORSPHQW RI DFDGHPLF VNLOOV DQG

,QWURGXFWLRQ PRWRU VNLOOV ZHUFH\W\H\W\QGDQ\ PRWRU VNLOOV ZHUFH\W\H\W\QGDQ\ RI @

& XUHHQWO\ WKUH LV FRQVLGHUDEOH ZRUOGZLGH FRPPLWPHQW DPRQ\W\H\W\QGDQ\
FOLQLFLDQV WR EHFRPH UHVSRLQLEOH VWHZDUGV RI EHVVW SDFWLFH DQG WR D
HYLGHQFH EDVHG SUDFWLFH LQ SURYLGQJ VHUYLHV > @ \$V SDUW RI WKLV WU
FOLQLFLDQV ZRUOGZLGH KDYH EHJXQ XVLQJ VWDQGDUGL]HG 8 6 WRROV ZLWK
VWURQQJ SV\FKRPHWULF SURSHUWLHV IRU FOLQLFDO SXUSRVHV ZLWK RU ZLWKRX
DSSURSULDWH FURVV F\K\W\H\W\QGDQ\ D\W\G\B\W\H\W\QGDQ\
QRUPDWLYH \$PHULFDQ GDWD IRU SXUSRVHV RI ORFDO SUDFWLFH ZLWK ORFDO
SRSXODWLRQV DV ZHOO DV WKH WUDQVODWLRQ DQG DGDSWDWLRQ RI \$PHULFD
LQVWUXPHQWV IRU XVH ZLWK SRSXODWLRQV VSHDNLQJ RWKHU ODQJXDJHV DQG
IURBLVHUF\W\H\W\QGDQ\ DUH LVVXHV GUDZLQJ LQFUHDVHG DWWHQWLRQ LQ
KHDOWK UHODWHG UHVHDUFK DQG SUDFWLFH > @)LQGLQJV IURP FURVV
FXOWXUDO VWXGLH\W\H\W\QGDQ\ H\W\QGDQ\ RQ
GHYHORSPHQWDO WHVWV DPLRV\H\W\QGDQ\ IURP
EDFNJURXQGV PD\ 6H\W\QGDQ\HEUXW\H\W\QGDQ\ JXDHV > @
FXOWXUDO SUDFWLFHV > @ WHVW PDWHDQW\W\QGDQ\ D\W\G\B\W\H\W\QGDQ\ SHUFHSWLR
VRFLRHFRQRPLF VWDWXV > @ DQG HQYURQPHQWDO D\W\G\B\W\H\W\QGDQ\ IURP
HVHQGL\W\H\W\QGDQ\ KOLJKW WKH QHHG WR HQVXUH WKDW WKH\QURPU\YRUPDOS WQVWLPZ
D\W\ DSSURSUM\W\H\W\QGDQ\ JURXSV EHLQJ\W\QGDQ\ GHYHORSLSQJ , QGLDQ FKLOGUH

'DWD DQDO\VLV

,VUDHOL

5DZ VFRUHV ZHUH FRQYHWHG LQWR	
'HFULSWLYH VWDWLWLFV ZHUH FRPSXWHG WR GHVFULEH GLVWULEXWLRQ RI WKH WHVWdV WKUHFWWDQGDXEGLYKHG & FRCRUA V %HHFRQWLQH WDEOHV ZHUH XVHG WR FDOVSXOFLVRLWKLWKRQH VHDQ SHUEHSWLQH REVHUYHG DQG SXEOLVKHG SHUIRUPDQFH VFRUHV > @ 3RUWQH DQG DWNLQV)ROORZLQJ FOLQLFDODSSOLFDWLRQV DQG SXEOLVKHG SURFGXUHV WKH REVHUYHG DQG FWKRRSXSOHCKFALQJ SHUFHDFPSPHLEHORZEVHUYHG 3HUIRUPDQFH QRUPDO IXQFWLRQDO OLPLWV ZDV D VFRUHVSHUFHDFPSPHQAPRDUHVZHWURVXEPLQWHGWR SUHOLPLQDUFKHFNV IRU PHH WLQJ WKHUBXWPSWLRQ RI QRUPDO GLVWULEXWLRQ DQG ZHUH IRXQG WR EH DGHTXDWHO\ QUPDOO\ GLVWULEXWHD 6WDWLWLFDDQDQ\ VHWZDUWQWY SHUWDLQJ WR WKFIDBTRPISDQDQDQ\VHV ZHUH FDUULHG RXW HPSOR\LOQH63663& UHVXOWV XWLOEXVXWIKHVRZLHMUKYWKRVH WKH SXEOLVKHG 8 6 QRUPFXVXWIKHVRZLHMUKYWKRVH 90, 93 DQG 0& WHVWV DUH SUHVHQW HG H REVHUYHG PHDQ SHUIRUPDQFH VFRUHVSHUFHDFPSPHQAPMWHUWQH 7DEOH 90, REVHUYHG PHDQ SHUIRUPDQFH 90, FKLOGUHQ ZDV VOLJKWO\ KLJKHU WKDQRWRPQOSXX@EWKRAQD860LQRPWVWXWFRPBUQ UHVSHFWLYHO\ ,Q UHJDUG WR WKH, FULDYHQGLD 7DEOH 90, REVHUYHG PHDQ SHUIRUPDQFH 90, FKLOGUHQ ZDV VOLJKWO\ KLJKHU WKDQRWRPQOSXX@EWKRAQD860LQRPWVWXWFRPBUQ UHVSHFWLYHO\ ,Q UHJDUG WR WKH SHUIRUPDQFH VFRUHV ZHUH KLJKHU WKDQRWRPQOSXX@EWKRAQD860LQRPWVWXWFRPBUQ UHVSHFWLYHO\ ,Q UHJDUG WR WKH SHUIRUPDQFH VFRUHV ZHUH KLJKHU WKDQRWRPQOSXX@EWKRAQD860LQRPWVWXWFRPBUQ UHVSHFWLYHO\ EXW ORZHU RQ WKH 0& WHHJFBDWYLDFDUWHRPGQW \$OO FODQGUHHLWKLQ WKH QRUPDO IXQFWLRQDO OLPLWUHFHLYHG D FQBVQDUFWIRPGQ)RU WKH ,VUDHOL JURXS WKH VHQLWLY SHUFHDFWVL }FDJDUHLHFRQHQW 1R FFODVQGLWUH E HORZ WKH 90, DQG 0& QRUPDO IXQFWLR SXEOLVKHGWDFRUV RU EHDODVWLRQFDFWV DFRUHV 2Q WKH 93 WHFONDVRQH }FDJDUHLHFRQHQW 1XQFWLRQDO OLPLWV DFFRUGLQJ WR WKH FODVVIEHORZ WKH QRUPDO IXQFWLRQDO SHUIRUPDQFH RQ WKH 0& WHVWV DQG 93 WHVWV 90, YV UHVSHFWLYHO\ 2Q WKH 93 FODVVL }FDJDUHLHFRQHQW 1XQFWLRQDO FODVVEHORZ WKH QRUPDO IXQFWLRQDO H VSHFL }FDJDUHLHFRQHQW 1XQFWLRQDO FODVVL }FDJDUHLHFRQHQW 1XQFWLRQDO FODVVEHORZ WKH QRUPDO IXQFWLRQDO WKH VWWGRUHV 2Q WKRRIQWKMHVWFKLOGUZHUHFDVVLWKLQ WKH QRUPDO IXQFWLRQDO FODVVL }FDJDUHLHFRQHQW 1XQFWLRQDO FODVVEHORZ WKH QRUPDO IXQFWLRQDO WKH QRUPDO IXQFWLRQDO SXEOLVKHG QGDPLVHEHORZ WKH QRUPDO IXQFWLRQDO WKH REVHUYHG SHUIRUPDQFH VFRUHV	
7HVV	
2EVHUYHG	
3XEOLVKHGD	
&XOWXUDO *URKS	
0 6'	
90,	
3DOHVWLQLDQ	
,VUDHOL	
\$PHULFDQ	
93	
3DOHVWLQLDQ	
,VUDHOL	
\$PHULFDQ	
0 &	
3DOHVWLQLDQ	

90,	93	0 &
&ODVVLILFDWLRQ		&ODVVLILFDWLRQ
%HORZ 1RUPDO	7RWDO	%HORZ 1RUPDO 7RWDO
2EVHUYHG3XEOLVKHG 1RUPV	3XEOLVKHG 1RUPV	3XEOLVKHG 1RUPV
3DOHVWLQLDQ *URXS		
%HORZ		
1RUPDO		

7RWDO

6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\

2EVHUYHG3XEOLV1KRHGP V
,VUDHOL *URXS

3XEOLV1KRHGP V

3XEOLV1KRHGP V

%HORZ

1RUPDO

7RWDO

6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6SHFLILFLW\

2EVHUYHG3XEOLV1KRHGP V
\$PHULFDQ
*URXS

3XEOLV1KRHGP V

3XEOLV1KRHGP V

%HORZ

1RUPDO

7RWDO

6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\ 6HQVLWLYLW\

1RWH2EVHUYHG DQG SXEOLVKHG SHUIRUPDQFH EHORZ WKH QRUPDO IXQFWLRQDO OLPLWV ZDV

GHLQHG DV D VFRUH 6' EHORZ WKH PHDQ

90, %HHU\ %XNWHQLFD 90, 9LVXDO 0RWRU ,QWHJUDWLRQ 7HVW 93 9LVXDO

SHUFHSWLRQ 7HVW 0& 0RWRU &RRUGLQDWLRQ WHVW

