Knowledge Ecosystems

Research: David A. Bray

Knowledge Ecosystems

Confronting Hyperturbulent Environments

(1) ..... Definitions
(2) ..... Imperatives
(3) ..... Theories
(4) ..... Methods
(5) ..... Conclusions

Definitions: The “What”

(1)

my background:

IT Chief of the Bioterrorism Preparedness and Response Program, U.S. Centers for Disease Control 2000-2005

my background:

planned originally to work 2 years, then join Peace Corps

(but the world had other plans)

knowledge ecosystems:

grassroots
knowledge “cultivation”

knowledge ecosystems:

(1) provide opportunities
(2) provide motivations
(3) provide methods/protocols

knowledge ecosystems:

(1) organizational opportunities
(2) behavioral antecedents
(3) exchange activities

hyperturbulent environments:

where organic,
information-intensive changes
occur rapidly with little warning

hyperturbulent environments:

compared to “ordinary” turbulent environments require greater inter-individual knowledge exchanges to adapt

hyperturbulent environments:

no one individual harbors sufficient knowledge to mitigate negative outcomes

hyperturbulent environments:

no one individual harbors sufficient knowledge to capitalize positive opportunities

hyperturbulent environments:

inter-individual exchanges
must transcend
physical group proximity

hyperturbulent environments:

inter-individual exchanges
must transcend
institutions and social networks

Imperatives: The “Why”

(2)

Global Trends: 2015

"The networked global economy will be driven by rapid and largely unrestricted flows of information, ideas…"

“Its evolution will be rocky, marked by chronic financial volatility…”

“Groups feeling left behind will face deepening economic stagnation, political instability, and cultural alienation...”

“Globalization will create demands for increased international cooperation on transnational issues...”

“Nonstate actors ranging from business firms to nonprofit organizations will play increasingly larger roles...”

"Less and less control over flows of information, technology, diseases, migrants, arms, and financial transactions…"

"Effective governance will increasingly be determined by the ability and agility... to exploit increased information flows, new technologies..."

exchanges of knowledge
allow humans to
relay thoughts

exchanges of knowledge
allow humans to
relay perceptions of the
environment

exchanges of knowledge
allow humans to
adapt

→ knowledge ecosystems

knowledge ecosystems allow inter-individual awareness of

reality

knowledge ecosystems allow inter-individual awareness of

opportunities

knowledge ecosystems allow inter-individual awareness of

changes and trends

knowledge ecosystems can increase adaptedness

knowledge ecosystems can be time-sensitive

knowledge ecosystems can be critical to survival

especially in hyperturbulent environments

9/11
anthrax events and SARS
Hurricane Katrina, 2005

hyperturbulent environments

examples where
sufficient knowledge
existed

to mitigate negative outcomes

examples where insufficient exchanges occurred to

mitigate negative outcomes

U.S. GAO Reports (2001-2006)
insufficient exchanges
occurred to

mitigate negative outcomes

Central Intelligence Agency,
Centers for Disease Control,
Federal Emergency
Management Agency

mitigate negative outcomes

Central Intelligence Agency,
Centers for Disease Control,
Federal Emergency
Management Agency

confront
hyperturbulent environments

these organizations represent
future business trends

confront
hyperturbulent environments

globally distributed individuals
must exchange
time-sensitive knowledge to

confront
hyperturbulent environments

hyperturbulent environments:

inter-individual exchanges
must transcend
institutions and social networks

hyperturbulent environments:

top-down “management”
of knowledge not possible
events organic and too dynamic

must answer: what do individuals know?

knowledge “management” not possible

must answer: what do individuals not know?

knowledge “management” not possible

must answer: what is valuable to know now?

knowledge “management” not possible

must answer: what will be valuable to know later?

knowledge “management” requires omniscience

must answer: what will be irrelevant to know later?

knowledge “management” requires omniscience

must answer: what changes will require new knowledge?

knowledge “management” requires omniscience

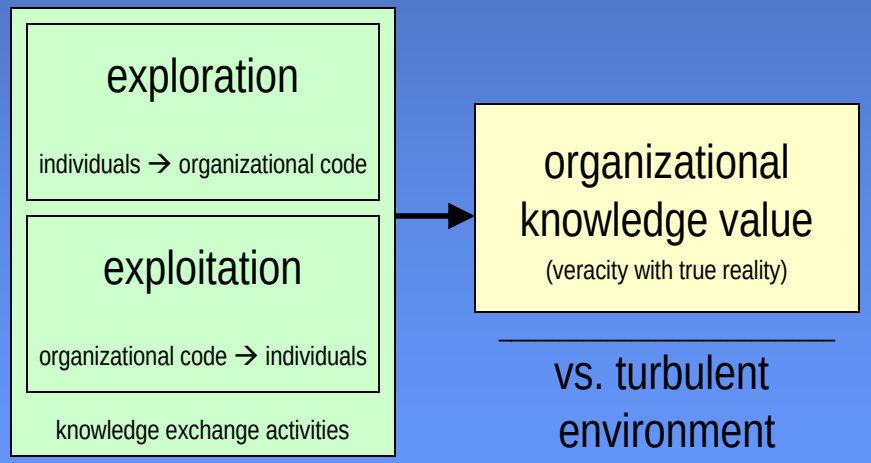
but maybe grassroots knowledge “cultivation” is possible?

start from the bottom-up

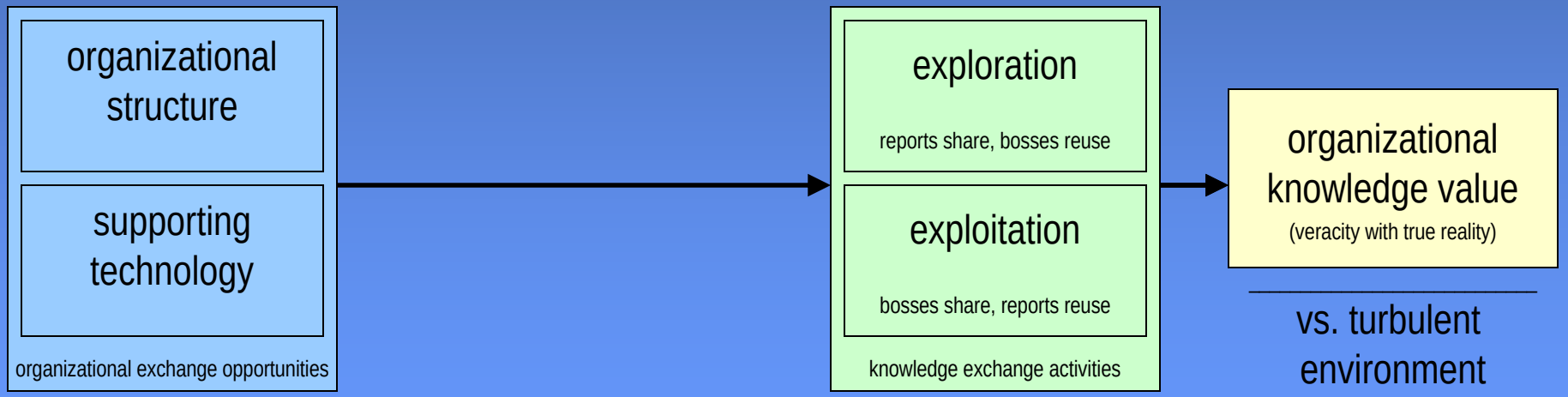
Theories: The “How”

(3)

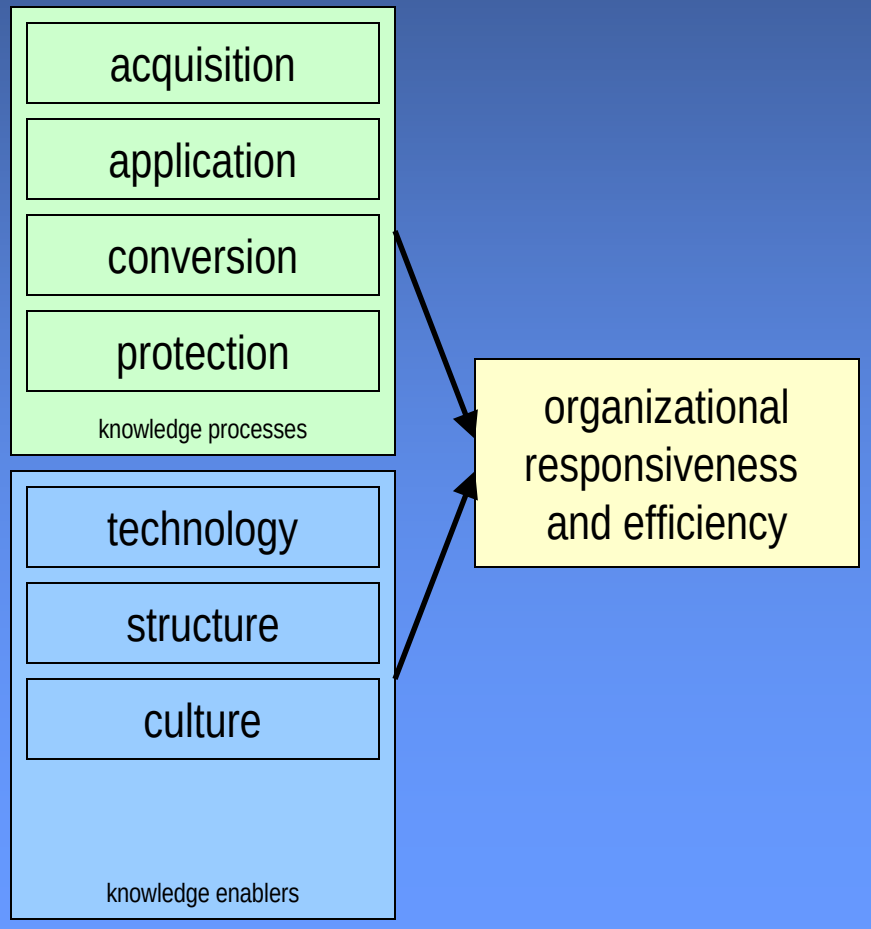
March (1991)


exploration
individuals → organizational code
exploitation
organizational code → individuals
knowledge exchange activities
organizational knowledge value
(veracity with true reality)
vs. turbulent environment

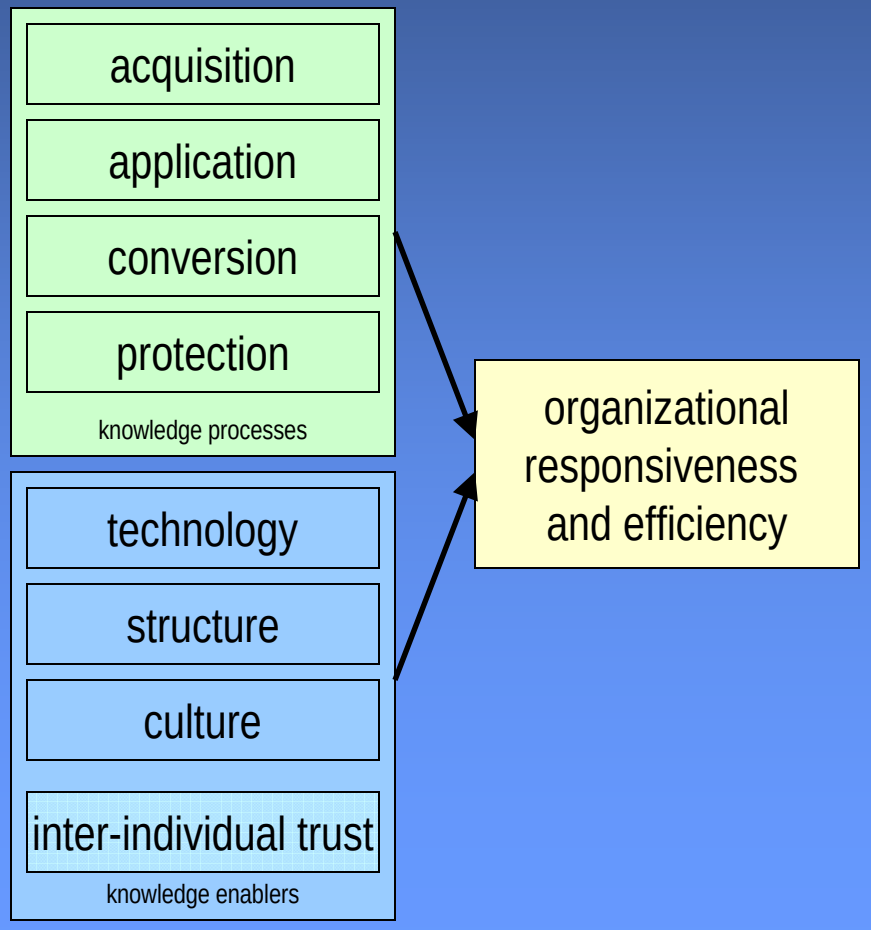
Doctoral research, part 1



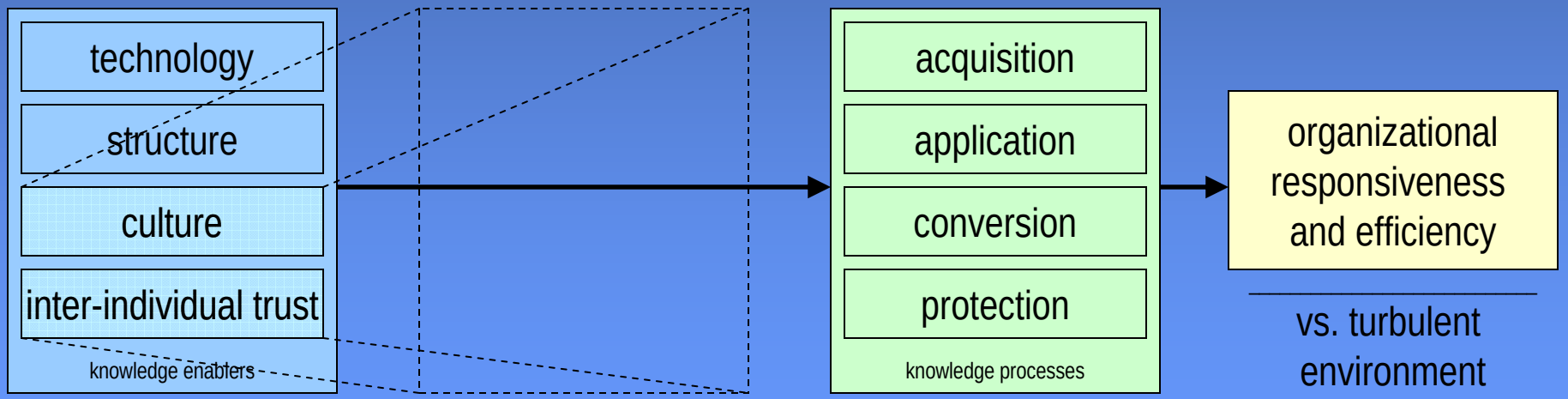
Extending sociotech and knowledge mgmt literature:



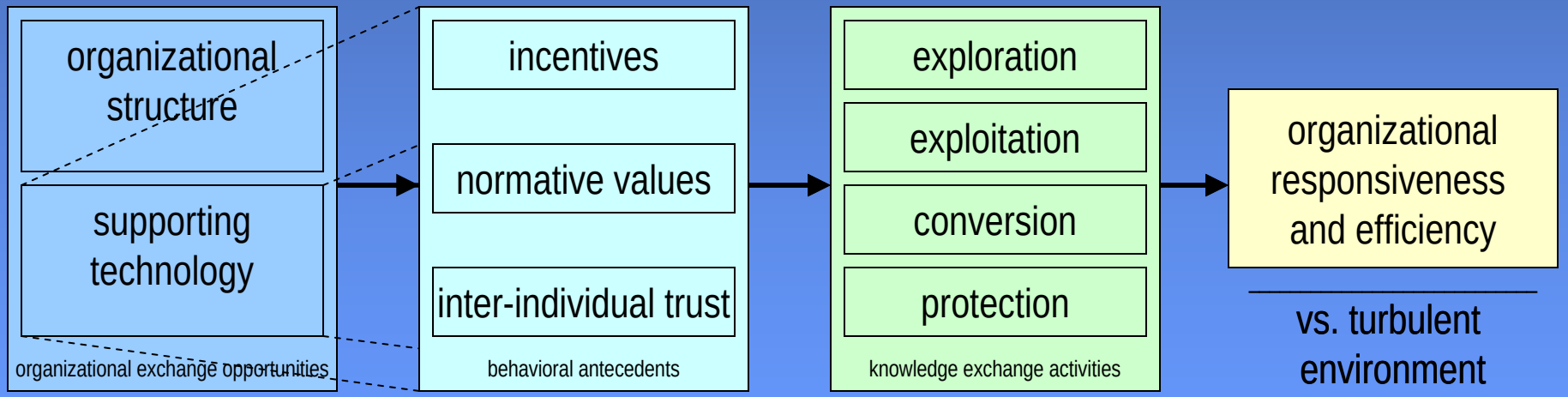
Doctoral research, part 2



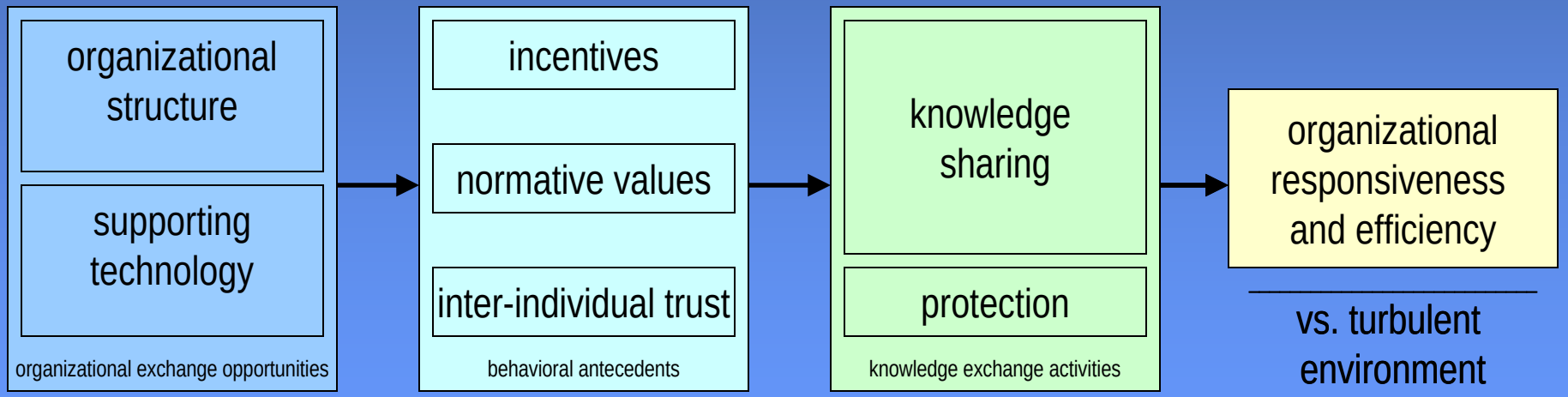
Doctoral research, part 2



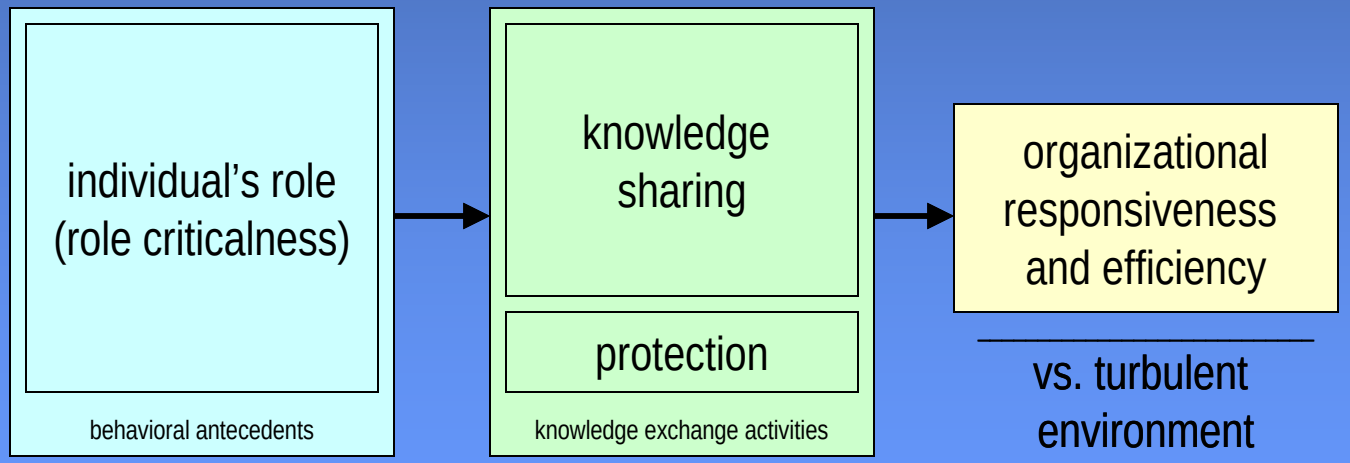
Doctoral research, part 2



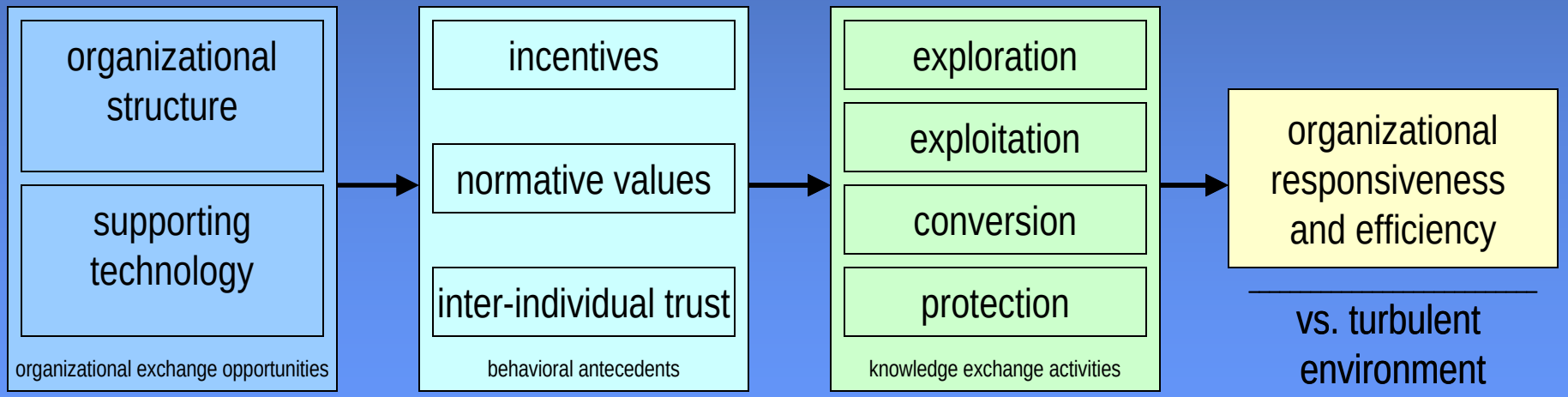
Knowledge sharing, protection, and social dilemmas:



Doctoral research, part 3



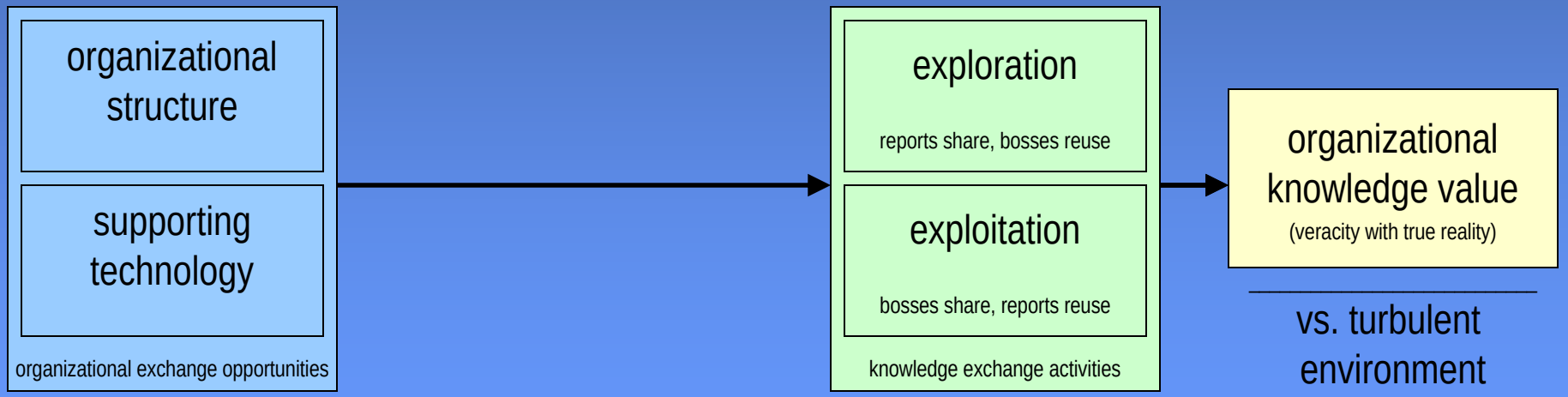
Towards a cumulative theory



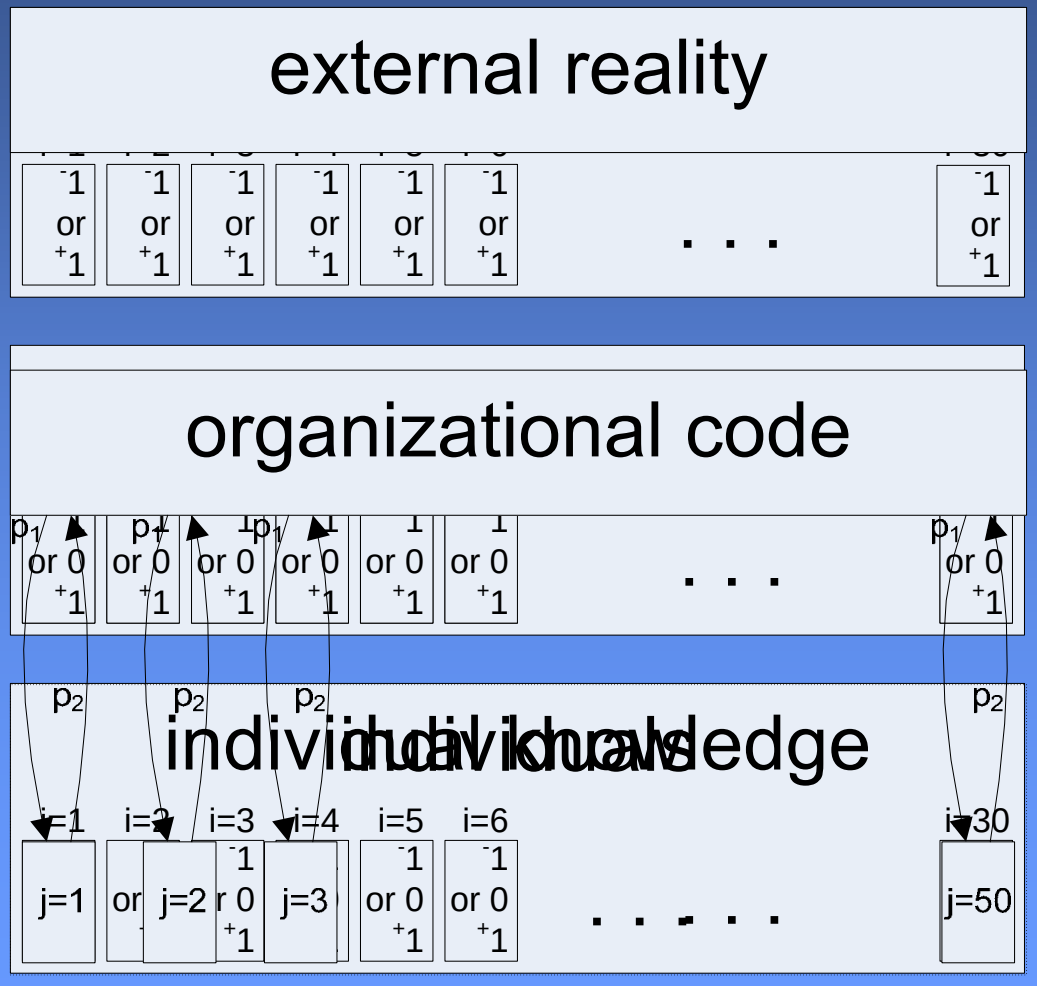
Methods: Models & Empiricism

(4)

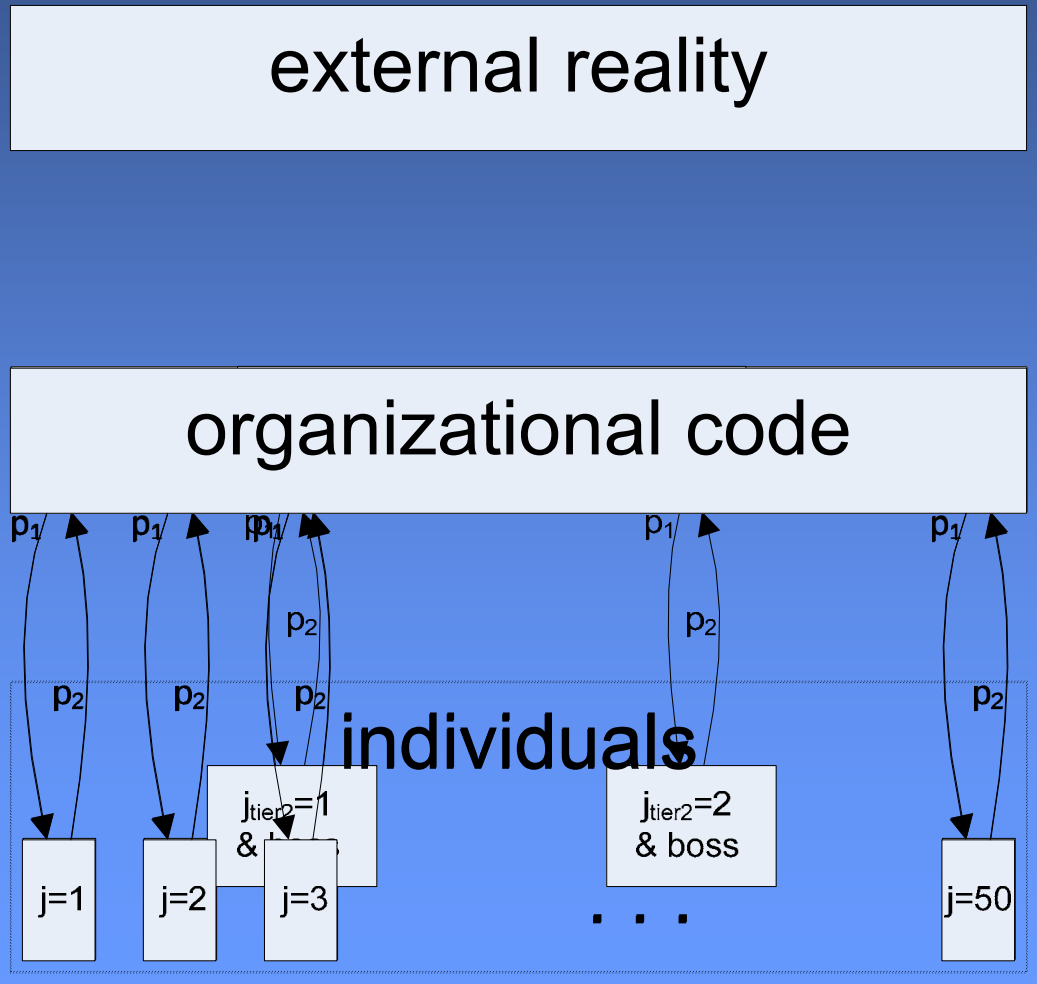
1: Simulation model extend March's theory, test via multiple regressions



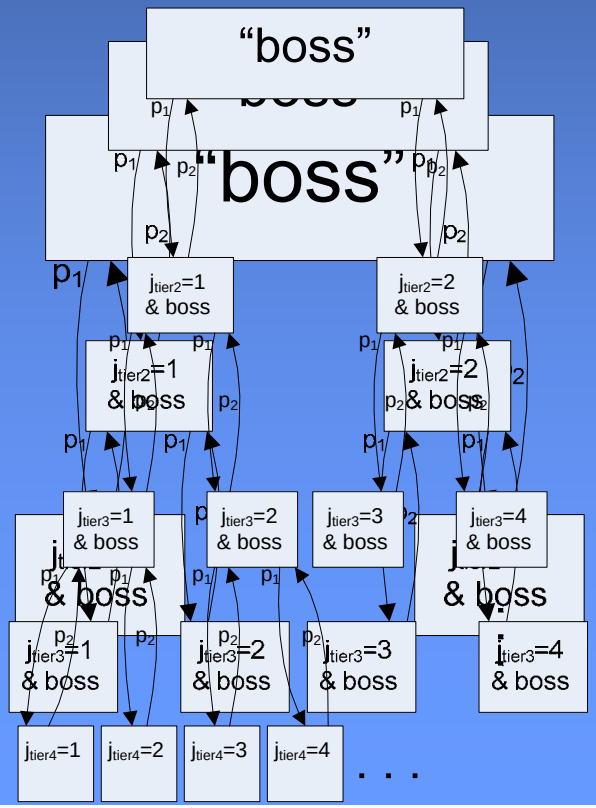
1: Simulation model



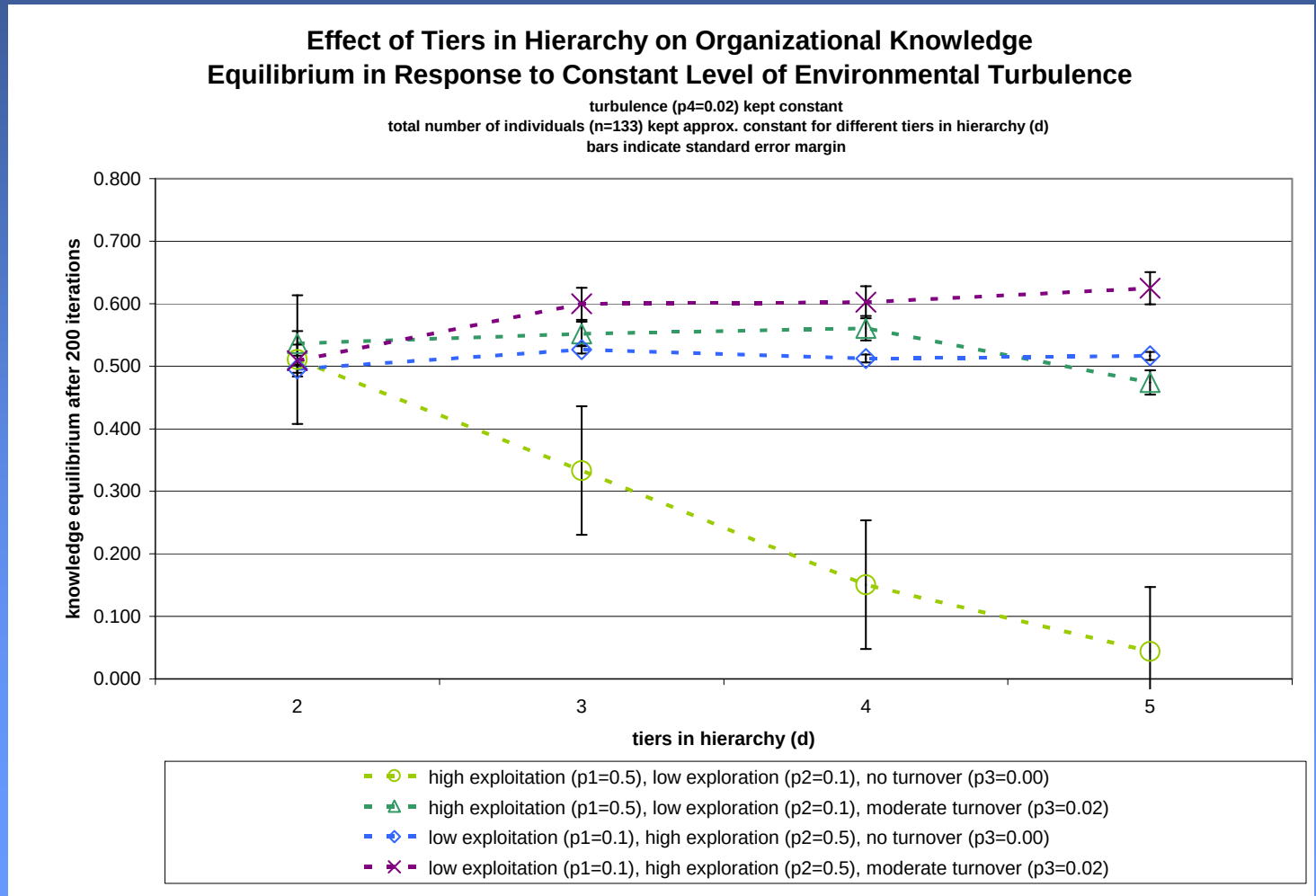
1: Simulation model



1: Simulation model



1: Simulation model



1: Simulation model

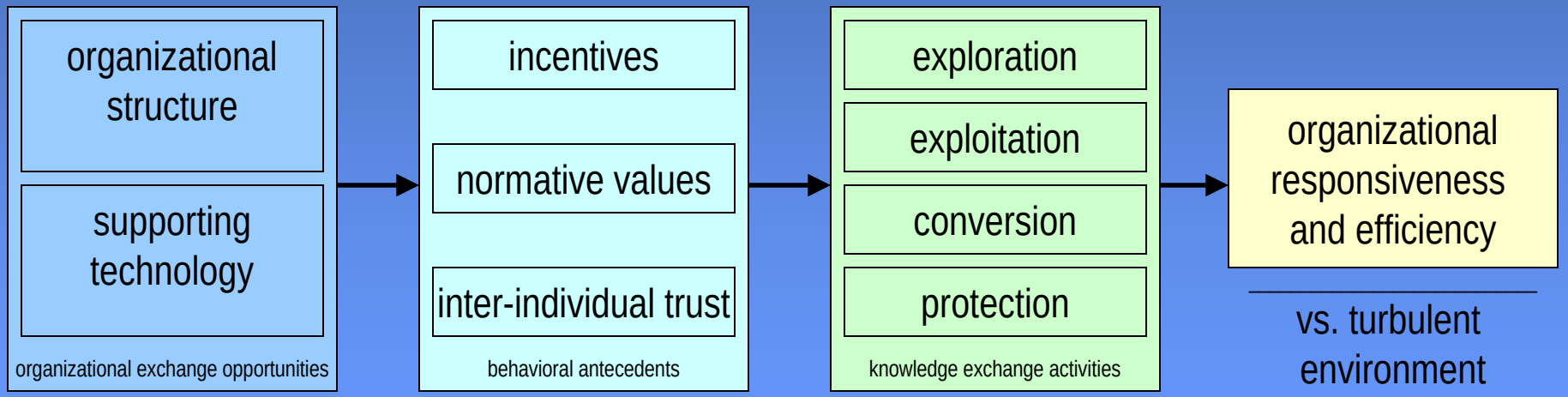
Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.658	.006		117.572	.000		
	probP1	.170	.014	.300	12.330	.000	.176	5.688
	probP2	.124	.006	.215	21.039	.000	1.000	1.000
	probP3	2.118	.118	.182	17.875	.000	1.000	1.000
	probP4	-5.646	.118	-.488	-47.876	.000	.999	1.001
	interactP1Depth	-.055	.003	-.446	-17.104	.000	.153	6.549
	countBreadth	-.001	.000	-.297	-21.028	.000	.520	1.922

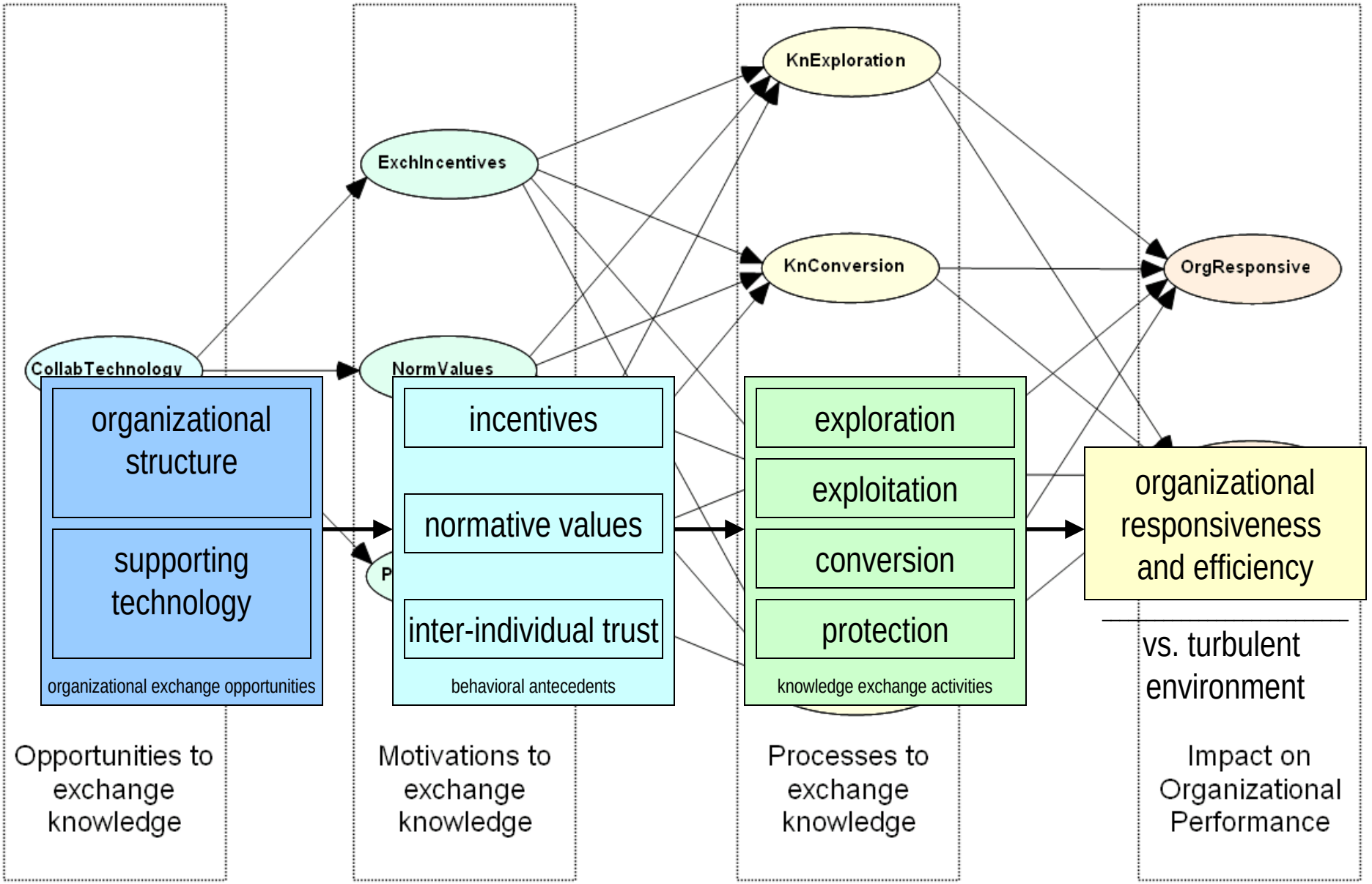
a. Dependent Variable: corrOrgCMatch

b. Weighted Least Squares Regression - Weighted by countDepth

2 & 3: Institutional field study collect data, test theory via structural equation models



2 & 3: Institutional Field Study



2 & 3: Institutional Field Study

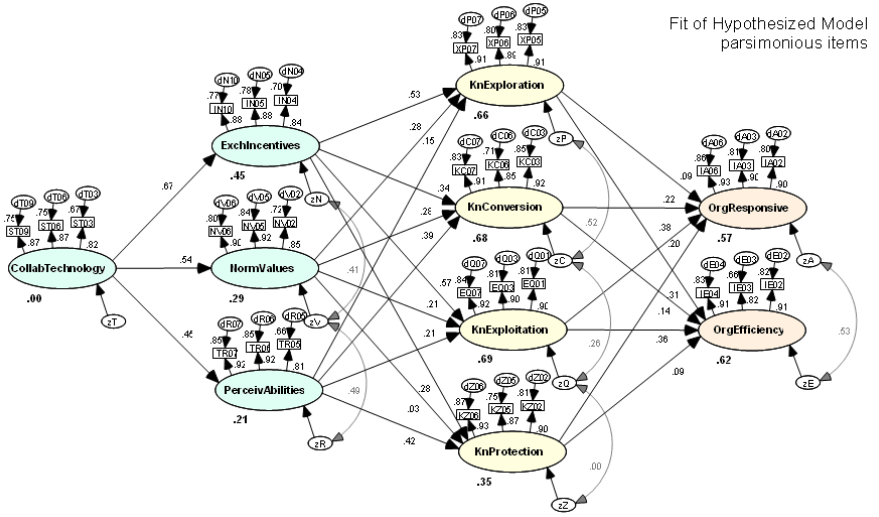
Below are the correlations for a for a more parsimonious model

= HIGH correlation among items (> .700)
= MODERATE correlation among items (between .500 and .700)
= WEAK correlation among items (between .300 and .500)
= VERY WEAK correlation among items (< .300)

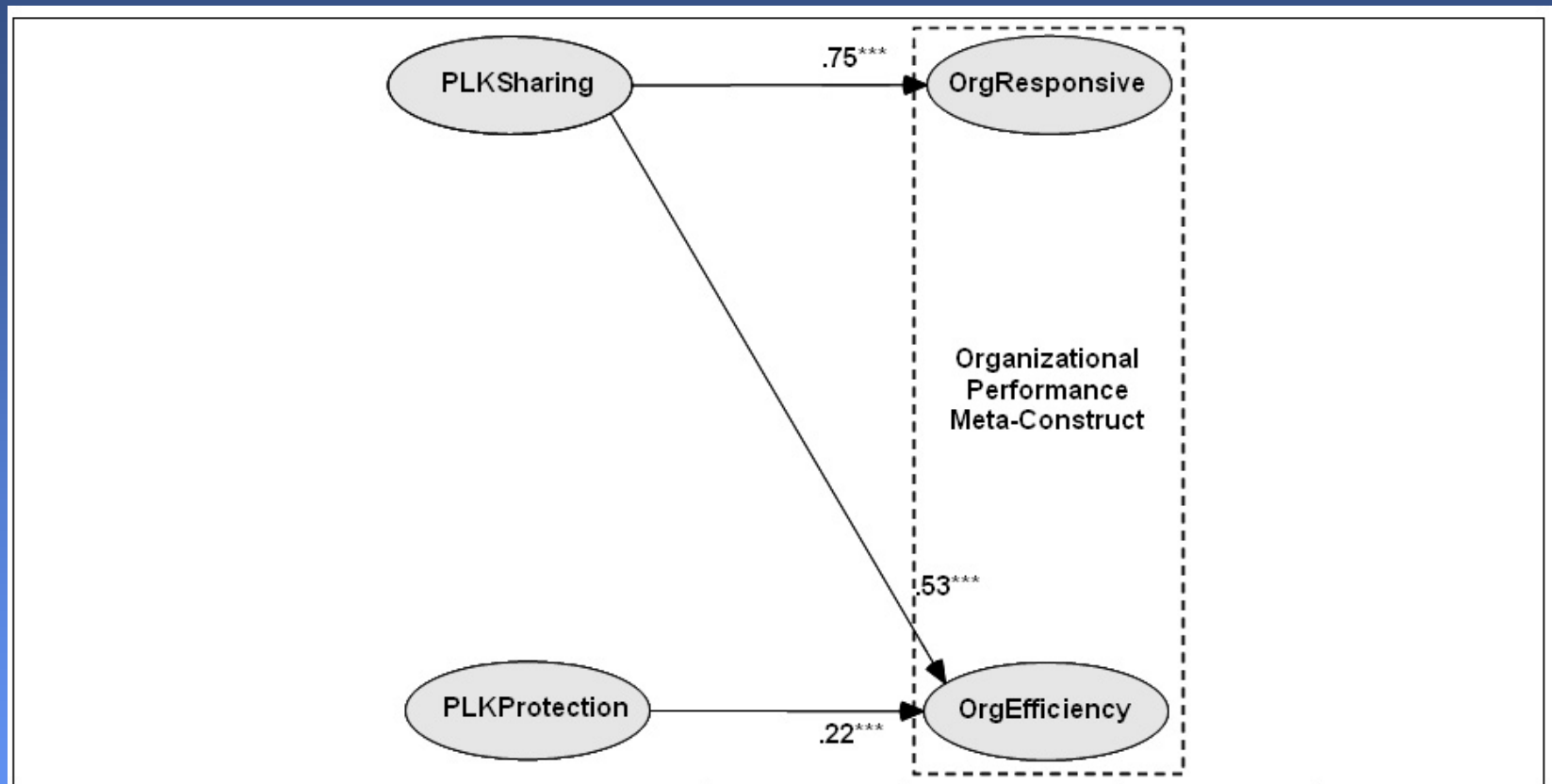
	IITRUST05	IITRUST06	IITRUST07	KOONVP03	KOONVP06	KOONVP07	NVALLES02	NVALLES05	NVALLES06	XPLOR05	XPLOR06	XPLOR07	INCENT04	INCENT05	INCENT10	KPROTP02	KPROTP05	KPROTP06	STECH03	STECH06	STECH09	XPLOIT01	XPLOIT03	XPLOIT07	KIRESP02	KIRESP03	KIRESP06	KIEFFIC02	KIEFFIC03	KIEFFIC04
IITRUST05	1.000																													
IITRUST06	0.743	1.000																												
IITRUST07	0.742	0.856	1.000																											
KOONVP03	0.527	0.580	0.575	1.000																										
KOONVP06	0.470	0.501	0.494	0.783	1.000																									
KOONVP07	0.544	0.555	0.551	0.853	0.773	1.000																								
NVALUES02	0.536	0.535	0.533	0.648	0.628	0.660	1.000																							
NVALUES05	0.535	0.503	0.501	0.566	0.525	0.589	0.770	1.000																						
NVALUES06	0.515	0.486	0.484	0.584	0.558	0.577	0.737	0.848	1.000																					
XPLOR05	0.430	0.418	0.412	0.696	0.668	0.686	0.620	0.573	0.572	1.000																				
XPLOR06	0.443	0.405	0.406	0.665	0.671	0.641	0.628	0.557	0.563	0.820	1.000																			
XPLOR07	0.415	0.396	0.393	0.689	0.687	0.688	0.616	0.534	0.537	0.826	0.814	1.000																		
INCENT04	0.296	0.272	0.271	0.491	0.528	0.480	0.528	0.478	0.466	0.564	0.553	0.587	1.000																	
INCENT05	0.301	0.284	0.281	0.490	0.508	0.493	0.531	0.509	0.488	0.590	0.584	0.609	0.749	1.000																
INCENT10	0.299	0.301	0.297	0.494	0.505	0.482	0.523	0.491	0.480	0.543	0.561	0.579	0.739	0.788	1.000															
KPROTP02	0.390	0.448	0.445	0.413	0.389	0.430	0.400	0.338	0.340	0.396	0.353	0.410	0.354	0.310	0.322	1.000														
KPROTP05	0.376	0.392	0.398	0.454	0.378	0.463	0.388	0.348	0.357	0.421	0.381	0.427	0.387	0.345	0.357	0.781	1.000													
KPROTP06	0.421	0.448	0.450	0.438	0.425	0.450	0.415	0.386	0.376	0.416	0.393	0.429	0.340	0.328	0.344	0.840	0.809	1.000												
STECH03	0.340	0.337	0.335	0.416	0.456	0.464	0.437	0.382	0.375	0.399	0.416	0.409	0.373	0.416	0.451	0.330	0.355	0.341	1.000											
STECH06	0.351	0.356	0.348	0.482	0.520	0.498	0.462	0.383	0.391	0.480	0.525	0.516	0.460	0.478	0.528	0.347	0.318	0.330	0.713	1.000										
STECH09	0.307	0.328	0.326	0.469	0.534	0.479	0.442	0.400	0.358	0.487	0.485	0.490	0.491	0.486	0.533	0.328	0.328	0.324	0.715	0.746	1.000									
XPLOIT01	0.409	0.435	0.437	0.662	0.619	0.656	0.602	0.551	0.526	0.620	0.626	0.651	0.558	0.565	0.574	0.359	0.392	0.365	0.458	0.536	0.548	1.000								
XPLOIT03	0.374	0.431	0.426	0.622	0.610	0.633	0.601	0.574	0.520	0.633	0.631	0.668	0.570	0.607	0.608	0.425	0.433	0.431	0.485	0.537	0.577	0.818	1.000							
XPLOIT07	0.427	0.447	0.442	0.652	0.592	0.654	0.580	0.570	0.539	0.627	0.629	0.634	0.575	0.602	0.616	0.342	0.378	0.345	0.474	0.531	0.573	0.829	0.828	1.000						
KIRESP02	0.474	0.514	0.506	0.583	0.526	0.584	0.549	0.549	0.517	0.552	0.532	0.536	0.442	0.462	0.487	0.416	0.452	0.460	0.396	0.400	0.401	0.589	0.591	0.581	1.000					
KIRESP03	0.477	0.509	0.506	0.574	0.515	0.570	0.548	0.554	0.522	0.542	0.533	0.523	0.429	0.456	0.478	0.395	0.444	0.456	0.383	0.386	0.381	0.592	0.576	0.572	0.790	1.000				
KIRESP06	0.502	0.520	0.509	0.572	0.517	0.549	0.588	0.594	0.573	0.557	0.559	0.523	0.442	0.446	0.471	0.396	0.436	0.461	0.398	0.377	0.373	0.591	0.581	0.585	0.839	0.850	1.000			
KIEFFIC02	0.404	0.434	0.424	0.590	0.550	0.605	0.550	0.458	0.424	0.606	0.583	0.625	0.489	0.499	0.467	0.392	0.434	0.396	0.380	0.445	0.473	0.604	0.609	0.598	0.680	0.664	0.633	1.000		
KIEFFIC03	0.374	0.424	0.414	0.550	0.502	0.533	0.515	0.467	0.406	0.557	0.533	0.584	0.517	0.502	0.520	0.307	0.396	0.326	0.349	0.379	0.447	0.610	0.560	0.612	0.673	0.660	0.655	0.730	1.000	
KIEFFIC04	0.410	0.431	0.431	0.594	0.550	0.610	0.560	0.467	0.430	0.609	0.589	0.625	0.483	0.502	0.469	0.384	0.434	0.389	0.375	0.434	0.473	0.606	0.601	0.604	0.678	0.664	0.633	0.846	0.741	1.000

2 & 3: Institutional Field Study

Hypothesized model - parsimonious items:			Gold et al model - parsimonious items:		
GFI =	0.8994	(1 being highest)	GFI =	0.6823	(1 being highest)
AGFI =	0.8756	(1 being highest)	AGFI =	0.6100	(1 being highest)
RMSEA =	0.0611	(ideally < 0.800)	RMSEA =	0.1298	(ideally < 0.800)
NFI =	0.9474	(1 being highest)	NFI =	0.8053	(1 being highest)
IFI =	0.9539	(1 being highest)	IFI =	0.8104	(1 being highest)
CMIN =	2913.0540	(0 = saturated model)	CMIN =	9693.7660	(0 = saturated model)
DF =	376		DF =	308	
N =	1809	(survey size)	N =	1809	(survey size)
Hypothesized model - all items:			Gold et al model - all items:		
GFI =	0.6993	(1 being highest)	GFI =	0.6792	(1 being highest)
AGFI =	0.6795	(1 being highest)	AGFI =	0.6577	(1 being highest)
RMSEA =	0.0676	(ideally < 0.800)	RMSEA =	0.0750	(ideally < 0.800)
NFI =	0.8637	(1 being highest)	NFI =	0.8488	(1 being highest)
IFI =	0.8766	(1 being highest)	IFI =	0.8604	(1 being highest)
CMIN =	25424.5783	(0 = saturated model)	CMIN =	26006.8759	(0 = saturated model)
DF =	2756		DF =	2329	
N =	1809	(survey size)	N =	1809	(survey size)



2 & 3. Survey Indications



MODEL	GFI	AGFI	NFI	CFI
RC=1, Critical Employee Roles	0.9044	0.8446	0.9464	0.9593

***** = p-values < 0.0005 (all path estimates are standardized)**

Figure 2: Results of 2st Structural Equation, Path Between (PLKP) and (OR) Not Significant at < 0.05

2 & 3. Survey Indications

Y_1 = Organizational Responsiveness

Model Summary

Model	R	R Square	Adjusted R Square
1	.684[a]	.468	.467
2	.690[b]	.476	.474

a. Predictors: (Constant), RC, mPLKS, mPLKP

b. Predictors: (Constant), RC, mPLKS, mPLKP, inPLKS_RC, inPLKP_RC

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2760.005	3	920.002	529.246	.000[a]
	Residual	3137.676	1805	1.738		
	Total	5897.681	1808			
2	Regression	2804.516	5	560.903	326.949	.000[b]
	Residual	3093.165	1803	1.716		
	Total	5897.681	1808			

a. Predictors: (Constant), RC, mPLKS, mPLKP

b. Predictors: (Constant), RC, mPLKS, mPLKP, inPLKS_RC, inPLKP_RC

c. Dependent Variable: mOR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-.003	.034		-.098	.922		
	mPLKS	.521	.019	.514	26.783	.000	.799	1.252
	mPLKP	.298	.021	.277	14.350	.000	.792	1.262
	RC	.023	.089	.004	.259	.795	.988	1.012
2	(Constant)	-.006	.033		-.186	.852		
	mPLKS	.485	.021	.479	23.261	.000	.685	1.460
	mPLKP	.340	.023	.316	14.657	.000	.624	1.602
	RC	-.051	.089	-.019	-.563	.573	.959	1.043
	mPLKS_RC	.243	.055	.094	4.390	.000	.640	1.563
	inPLKP_RC	-.224	.051	-.099	-4.404	.000	.575	1.739

a. Dependent Variable: mOR

Y_2 = Organizational Efficiency

Model Summary

Model	R	R Square	Adjusted R Square
1	.615[a]	.378	.377
2	.617[b]	.381	.380

a. Predictors: (Constant), RC, mPLKS, mPLKP

b. Predictors: (Constant), RC, mPLKS, mPLKP, inPLKS_RC, inPLKP_RC

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2103.377	3	701.126	365.496	.000[a]
	Residual	3462.506	1805	1.918		
	Total	5565.883	1808			
2	Regression	2121.860	5	424.372	222.165	.000[b]
	Residual	3444.023	1803	1.910		
	Total	5565.883	1808			

a. Predictors: (Constant), RC, mPLKS, mPLKP

b. Predictors: (Constant), RC, mPLKS, mPLKP, inPLKS_RC, inPLKP_RC

c. Dependent Variable: mOE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-.013	.035		-.364	.716		
	mPLKS	.429	.020	.436	21.010	.000	.799	1.252
	mPLKP	.289	.022	.277	13.270	.000	.792	1.262
	RC	-.197	.094	-.039	-2.099	.036	.988	1.012
2	(Constant)	-.015	.035		-.426	.670		
	mPLKS	.410	.022	.417	18.636	.000	.685	1.460
	mPLKP	.322	.025	.308	13.119	.000	.624	1.602
	RC	-.248	.095	-.049	-2.608	.009	.959	1.043
	mPLKS_RC	.127	.058	.050	2.173	.030	.640	1.563
	inPLKP_RC	-.162	.054	-.073	-3.005	.003	.575	1.739

a. Dependent Variable: mOE

2 & 3. Survey Indications

- Interesting Institutional Findings:
  - Normative values (to exchange knowledge) and inter-individual, competence-based trust are both HIGH; while incentives are LOW (disincentives present)
  - Quality of knowledge exchange processes correlate MODERATELY (0.5 to 0.7) with organizational responsiveness and efficiency
  - Survey respondents do not perceive a difference between knowledge exploration and knowledge conversion → new knowledge from outside the organization is not distinguished from converting knowledge already present in organization
  - Knowledge protection processes quite HIGH, independent of other constructs
  - Role-criticality of personnel does influence perceived contribution of knowledge sharing and protection to organizational responsiveness and efficiency

2 & 3. Survey Indications

- High statistical significance:
  - Variations between organizational levels and personnel roles
  - Normative values to exchange knowledge vary between hiring mechanisms
  - Certain (curvilinear) variations between organizational tenure groups
  - The more emergency responses an individual has been involved with, the greater the reported desire of an individual for additional knowledge collaboration supporting technology
- No significant variance found:
  - For all knowledge processes between hiring mechanisms
  - For inter-individual trustworthiness or knowledge exploration processes between organizational levels → people generally trust those who they see daily, less trustful of those who they do not see or interact with often

2 & 3. Survey Indications

- Proposed theory sustained:
  - Improved collaboration opportunities, facilitated by technology, improve individual perceptions of knowledge exchange incentives, normative values, and trust
  - In turn, improved individual perceptions of knowledge exchange incentives substantially improve knowledge exploration and exploitation processes
  - In turn, improved knowledge exploration and exploitation processes improve organizational responsiveness and efficiency

  - OF NOTE: this 4 staged-model has a significantly better fit than existing models in the academic literature

Conclusions: A Recap

(5)

hyperturbulent environments:

where top-down knowledge “management” is indeterminate and not possible

hyperturbulent environments:

instead, strive for grassroots knowledge “cultivation”

human perceptions
of incentives, values, and trust

are influenced by
organizational structure and
supporting technology

human perceptions
of incentives, values, and trust
combined with technology

ultimately influence
responsiveness and efficiency

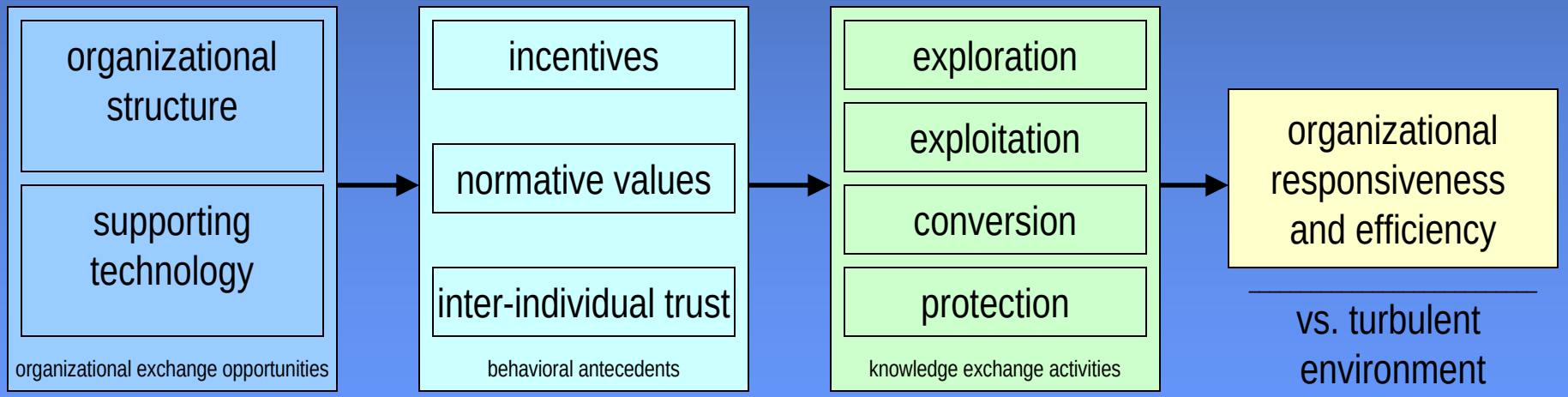
human perceptions
of knowledge sharing and
protection processes

are influenced by
the role-criticality of personnel
in an organization

knowledge ecosystems:

(1) provide opportunities
(2) provide motivations
(3) provide methods/protocols

knowledge ecosystems: increase organizational adaptedness



(questions?)

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