

Oil and Governance

National oil companies (NOCs) play an important role in the world economy. They produce most of the world's oil and bankroll governments across the globe. Although NOCs superficially resemble private-sector companies, they often behave in very different ways. Oil and Governance explains the variation in performance and strategy for NOCs and provides fresh insights into the future of the oil industry as well as the politics of the oil-rich countries where NOCs dominate. It comprises fifteen case studies, each following a common research design, of NOCs based in the Middle East, Africa, Asia, Latin America, and Europe. The book also includes cross-cutting pieces on the industrial structure of the oil industry and the politics and administration of NOCs. This book is the largest and most systematic analysis of NOCs to date and is suitable for audiences from industry and academia, as well as policymakers.

DAVID G. VICTOR is a professor at the School of International Relations and Pacific Studies at the University of California, San Diego, where he also leads the Laboratory on International Law and Regulation.

DAVID R. HULTS is a research affiliate at the Program on Energy and Sustainable Development (PESD) at Stanford University.

MARK C. THURBER is associate director at the Program on Energy and Sustainable Development (PESD) at Stanford University.





Oil and Governance

State-Owned Enterprises and the World Energy Supply

DAVID G. VICTOR
DAVID R. HULTS
MARK C. THURBER





CAMBRIDGE UNIVERSITY PRESS

Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi, Tokyo, Mexico City

Cambridge University Press

The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9781107004429

© David G. Victor, David R. Hults and Mark C. Thurber 2012

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2012

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data

Oil and governance: state-owned enterprises and the world energy supply / [edited by] David R. Hults, Mark C. Thurber, David G. Victor. p. cm.

Includes bibliographical references and index.

ISBN 978-1-107-00442-9 (hardback)

1. Petroleum industry and trade – History. 2. Petroleum industry and trade – Government policy. 3. Corporations, Government. I. Hults, David R. II. Thurber, Mark C. III. Victor, David G.

HD9560.5.O3654 2011

338.2'7282-dc23

2011037726

ISBN 978-1-107-00442-9 Hardback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.



Contents

Lis	t of figures	page viii
Lis	t of tables	xiv
Lis	t of boxes	xvi
Lis	t of contributors	xvii
Aci	knowledgements	xviii
	Part I Introduction	1
1	Introduction and overview DAVID G. VICTOR, DAVID R. HULTS, AND MARK C. THURBER	3
	Part II Thematic studies of national oil companies	33
2	The political economy of expropriation and privatization in the oil sector CHRISTOPHER WARSHAW	35
3	Hybrid governance: state management of national oil companies DAVID R. HULTS	62
4	On the state's choice of oil company: risk management and the frontier of the petroleum industry PETER A. NOLAN AND MARK C. THURBER	nt 121
	Part III National oil company case studies	171
5	Saudi Aramco: the jewel in the crown PAUL STEVENS	173

v



vi		Contents
6	Oil, monarchy, revolution, and theocracy: a study on the National Iranian Oil Company (NIOC) PAASHA MAHDAVI	234
7	Handcuffed: an assessment of Pemex's performance and strategy OGNEN STOJANOVSKI	280
8	Kuwait Petroleum Corporation (KPC): an enterprise in gridlock PAUL STEVENS	334
9	China National Petroleum Corporation (CNPC): a balancing act between enterprise and government BINBIN JIANG	379
10	Petróleos de Venezuela, S.A. (PDVSA): from independence to subservience DAVID R. HULTS	418
11	Awakening giant: strategy and performance of the Abu Dhabi National Oil Company (ADNOC) VARUN RAI AND DAVID G. VICTOR	478
12	Brazil's Petrobras: strategy and performance ADILSON DE OLIVEIRA	515
13	Sonatrach: the political economy of an Algerian state institution JOHN P. ENTELIS	557
14	Norway's evolving champion: Statoil and the politics of state enterprise MARK C. THURBER AND BENEDICTE TANGEN ISTAI	599 D
15	Gazprom: the struggle for power NADEJDA VICTOR AND INNA SAYFER	655
16	NNPC and Nigeria's oil patronage ecosystem MARK C. THURBER, IFEYINWA M. EMELIFE, AND PATRICK R. P. HELLER	701
17	Fading star: explaining the evolution of India's ONGC VARUN RAI	753



Contents	vii
18 Petronas: reconciling tensions between company and state LESLIE LOPEZ	809
19 Angola's Sonangol: dexterous right hand of the state PATRICK R. P. HELLER	836
Part IV Conclusions and implications	885
20 Major conclusions and implications for the future of the oil industry DAVID G. VICTOR, DAVID R. HULTS, AND MARK C. THURBER	887
Part V Appendices	929
Appendix A: our assessments of NOC performance DAVID G. VICTOR, DAVID R. HULTS, AND MARK C. THURBER	931
Appendix B: assessing NOC performance and the role of depletion policy PAUL STEVENS	940
References	946
Index	1000



Figures

1.1	Schematic for this study	page 21
1.2a	Liquids reserves on working interest basis as of	
	October 2009	25
1.2b	2008 liquids production on working interest basis	25
1.3a	Gas reserves on working interest basis as of	
	October 2009	26
1.3b	2008 gas production on working interest basis	26
2.1	Number of countries expropriating assets in the	
	oil sector	44
2.2	Number of countries privatizing national	
	oil companies	45
2.3	Marginal effect of executive constraints on	
	predicted probability of expropriation	51
3.1	Select elements of NOC governance systems	64
3.2	Sample NOC governance system as part of the	
	principal-agent relationship	69
3.3	NOC performance and organization of state actors	
	having authority over an NOC	80
3.4	NOC performance and mix of NOC oversight	
	mechanisms	84
3.5	NOC performance and reliance on law-based	
	mechanisms	86
4.1	The central idea: Petroleum risk and the state's	
	capacity for risk can constrain state choice of	
	hydrocarbon agent	123
4.2	Relative risk of petroleum investments (illustrative)	127
4.3	Investment risk as a function of petroleum province	
	maturity (illustrative)	130
4.4	The choice of operating company and state	
	participation when the state desires direct	
	control	144

viii



List o	of figures	ix
4.5	Water depth of the ninetieth percentile offshore	
	exploration well worldwide that was spudded in	
	the given year	155
4.6	Average fraction of exploration wells operated by	
	home NOC as a function of water depth relative	
	to the frontier, 1970–1989	159
4.7	Average fraction of exploration wells operated	
	by NOCs from 1970 through 2008, plotted alongside	
	oil price	161
5.1	Map of major oil and gas fields in Saudi Arabia	175
	Golden quadrant idea	185
	Oil revenues contribution to government revenue	194
	Oil GDP contribution to total GDP	195
	Oil contribution to merchandise export, 2003–2007	195
	Saudi Arabian and world oil output, 1940–2008	210
	Map of major oil and gas fields in Iran	238
	Organizational chart of NIOC and its subsidiaries	245
6.3	Government revenue from oil and gas sales,	
	1955–2009	248
	Oil within the Iranian political system	254
	Iranian oil and gas production, 1937–2007	260
	NIOC and OPEC	261
7.1	1 , 0	285
7.2	1 , 1	288
	Pemex crude oil production by field (1997–2010)	288
	Pemex capex, 1980–2010	303
	Map of major oil and gas fields in Kuwait	338
8.2	Organizational structure of the Kuwait	
0.2	petroleum sector	342
	Kuwaiti oil production, 1965–2006	356
	Evolution of the Chinese oil industry	381
	Map of major oil and gas fields in China	383
9.3	Oil production and oil consumption by product	20.6
0.4	group, 1965–2007	386
9.4	Chinese oil production and consumption,	201
0.5	1965–2007	391
	Top CNPC leadership employment history	399
9.6	0, 1	411
10.1	Map of major oil and gas fields in Venezuela	422



x List of figures

10.2	Distribution of Venezuelan proven liquid reserves by	
	type, 2007	438
10.3	Selected PDVSA operational data, 1987–2002	456
10.4	PDVSA liquids production, 1999–2007	462
11.1	Map of major oil and gas fields in UAE	483
11.2	UAE total oil production along with	
	OPEC allocations	485
11.3	Destination of crude oil production in 2007 from	
	ADMA-OPCO's lower Zakum fields	488
11.4	Top-level organizational structure of ADMA-OPCO	503
11.5	Overall facilities block diagram of GASCO's "Ruwais	
	3rd NGL Project," including OGD-III/AGD-II	504
11.6	ADNOC's gas flaring, 1996–2007	505
11.7	ADNOC's oil spills per year, 1996-2007	506
11.8	UAE's gas production and consumption,	
	1980–2008	508
12.1	Map of major oil and gas fields in Brazil	519
12.2	Brazilian oil production, consumption, and refinery	
	capacity, 1955-1965	524
12.3	Petrobras investments, 1954–1980	526
12.4	Petrobras investments, 1975–1995	529
12.5	Increasing water depth of pathbreaking	
	Petrobras wells over time	530
12.6	Deficit in the oil account, 1981–1992	532
12.7	Oil price and Petrobras production, 1975–1995	534
12.8	Number of licensed blocks	538
12.9	Petrobras key financial ratios, 1999–2008	539
12.10	Oil price and Petrobras production, 1990–2008	540
12.11	Natural gas production, 1954-2008	541
12.12	Exploration costs and oil prices, 1999–2008	541
12.13	Oil production per upstream employee, 1998–2008	542
12.14	Capacity utilization of refineries, 1997–2008	542
12.15	Refined oil per downstream employee, 1998–2008	543
12.16	Government revenues from oil exploration and	
	production, 1998–2007	544
	Map of major oil and gas fields in Algeria	560
	Algeria's petroleum reserves, 1980–2008	565
13.3	Hydrocarbon export value, total export value,	
	and GDP for Algeria	565



List of	f figures	xi
13.4	The 1998 institutional and energy policy	
	framework and Sonatrach's new corporate structure	570
13.5	Algeria's crude oil production, 1980–2007	584
	Map of major oil and gas fields in Norway	606
	Equity share of NCS production held by	
	different companies over time	607
14.3	Share of NCS production operated by different	
	companies over time	608
14.4	NCS production by hydrocarbon type and field	609
14.5	Oil and gas sector percentage contribution to GNP	
	and state revenue, 1971-2008	615
14.6	Market value of Government Pension Fund - Global,	
	1996–2008	617
14.7	Degree of success in achieving Norway's	
	"Action Rule"	617
14.8	Statoil annual net income, compared against	
	Brent crude oil spot price and Statoil NYSE	
	share price	630
14.9	Statoil's domestic (NCS) hydrocarbon entitlement	
	production by type, 1999–2008	631
14.10	Statoil's international hydrocarbon entitlement	
	production by type	631
	Statoil's reserves-to-production ratio, 1999–2008	632
14.12	Relative contribution of domestic and international	
	hydrocarbons to Statoil production, reserves,	
	and net operating income	633
14.13	Sources of Statoil international equity production	
	in 2008	633
14.14	Production costs on the NCS: Statoil, Norsk Hydro,	
	and StatoilHydro, with BP global production cost	
	as a benchmark	635
14.15	Production costs internationally: Statoil, Norsk Hydro,	
	and StatoilHydro, with BP global production	(2)
454	cost as a benchmark	636
	Russia: GDP growth and crude oil prices, 1966–2008	666
15.2	Russia: total export revenues versus crude	
	oil prices, 1966–2008, and GDP versus oil price,	<i>((</i> -
152	1994–2008	667
15.3	Global conventional gas reserves by country in 2008	668



xii List of figures

15.4	Russia: natural gas production, export, and	
	consumption, historical data, 1985-2008	670
15.5	Major Russian natural gas fields production from	
	West Siberia	671
15.6	Gazprom organization as of 2004	676
15.7		687
16.1	Map of major oil and gas fields in Nigeria	705
16.2	History of Nigerian oil and natural gas production,	
	showing annual petroleum export value as well as	
	the type of government in power	709
16.3	Nigerian oil production by business arrangement,	
	2005–2007	721
16.4	Amount and sources of Nigerian government oil	
	and gas revenue, 2004–2006	724
17.1	Map of major oil and gas fields in India	757
17.2	Crude oil imports and production in India, 1970–2006	769
17.3	Crude oil production by ONGC, 1960–2007	770
17.4	Natural gas production by ONGC, 1980–2007	770
17.5	Hydrocarbon reserves of ONGC (proven reserves),	
	2001–2009	771
17.6	Ultimate reserves accretion by ONGC	773
17.7	Financial performance of ONGC, 1995–2007	775
17.8	ONGC's return on assets and sales, 1995–2007	775
17.9	Distribution of pre-NELP and NELP acreage by	
	winning bidder	783
17.10	Concessions given by ONGC to downstream	
	companies	793
17.11	Distribution of ONGC's working capital into loans	
	and advances, and cash and bank balances	795
17.12	ONGC's current ratio (net current assets divided by	
	current liability) and debt-equity ratio	796
17.13	Multilayered principal–agent structure of ONGC	
	ownership and management	798
17.14	Impact of GoI's monitoring mechanism on	
	ONGC's performance	801
18.1	Map of major oil and gas fields in Malaysia	817
18.2	Sources of Petronas revenues	817
18.3	Petronas group oil and gas reserves	819
19.1	Map of major oil and gas fields in Angola	850



List of figures		xiii
19.2	Increasing production amid conflict and instability	853
19.3	Proved reserves	854
20.1	Schematic for this study	888
20.2	The spread of NOCs over time	893
20.3a	Functions characteristically undertaken by	
	NOCs in sample	897
20.3b	Composite hydrocarbon performance	
	of NOCs in sample	898
20.3c	Non-oil burdens on NOCs in sample	899
20.4	The impact of non-hydrocarbon	
	functions on performance	902
20.5	Partnerships and NOC strategy	916
20.6	Geography and NOC strategy	918
20.7	Goals and administration of the hydrocarbon	
	sector	922
20.8	Supply curves by type of hydrocarbon politics	923
20.9	Allocation of world oil production by type of	
	hydrocarbon politics	925
B.1	The depletion choices	941



Tables

1.1	NOCs sample, ordered by rank in working interest	
	liquids production in 2008	page 24
2.1	Effect of executive constraints on expropriations	49
2.2	Effect of executive constraints on privatizations	52
2.3	PESD case study universe	53
3.1	Frequency of state actors having significant authority	
	over an NOC	78
3.2	Frequency of various oversight mechanisms in governing	g
	NOCs	82
3.3	Frequency of formal and informal mechanisms	
	in governing NOCs	85
4.1	Effect of "frontier" character (water depth,	
	previous discoveries) and oil price on NOC	
	prevalence in exploration	157
4.2	Effect of "frontier" character (water depth,	
	previous discoveries) and oil price on NOC	
	prevalence in exploration, this time excluding	
	Brazil and Norway	162
5.1	Saudi Arabia - membership of oil governance institution	ns 189
6.1	Oil revenues in the fiscal budget (Iran)	249
7.1	Key financial indicators for 2000–2010	290
7.2	Allocation of capex (in % total capex) by Pemex	
	operating subsidiary	303
8.1	Production costs in Kuwait	349
9.1a	External decision-making governmental bodies	
	related to CNPC before March 2008	400
9.1b	External decision-making governmental bodies	
	related to CNPC after March 2008	400
9.2	Petroleum industry extra profit tax collection rate	406

xiv



List	of tables	XV
9.3	Comparison of key ratios for CNPC, PetroChina, and	
	ExxonMobil, 2007	408
10.1	Venezuelan presidents, 1959-present	425
	PDVSA payments to government budget, 2003–2008	448
	PDVSA extra-budgetary obligations, 2003–2008	449
	State control of PDVSA revenues, 2003–2008	458
	Total PDVSA investment, and investment in exploration	
	and production, 2003–2008	459
10.6	Estimated actual and planned PDVSA investment,	
	2003–2008	461
11.1	ADNOC's crude oil production expansion plans to	
	meet its 2015 target	493
13.1	Key players – Algerian hydrocarbons sector	572
	Russian oil and gas export, and total export revenues	667
15.2	Gazprom gas production in Russia by region	669
15.3	Gazprom's revenues, 2003–2008	678
16.1	Significant joint ventures with NNPC, with 2008	
	liquids production for each	711
17.1	Capital outlay allocated for ONGC in five-year	
	plans between 1975 and 1990	764
17.2	External assistance received by ONGC for	
	development of the Mumbai High fields	764
17.3	Declining crude oil production in early 1990s	765
17.4	Projected and actual oil production from ONGC's	
	Neelam fields	766
17.5	ONGC's reserves replacement ratio	774
17.6	Blocks offered, bids received, and contracts signed	
	for exploration blocks during pre-NELP rounds	780
17.7	Fields offered under joint venture development rounds	782
17.8	CSR expenditure by ONGC	790
19.1	Reported government receipts (Angola)	859



Boxes

1.1	What's in a name?	page 4
4.1	Frontier exploration uncertainties	129
4.2	Frontier development uncertainties	131
4.3	Managing exploration risk	135
4.4	Managing development risk	136
5.1	The attempted opening of the upstream in Saudi Arabia	189
6.1	The constitution of Iran	247
6.2	Iran's Oil Stabilization Fund and the rent	
	collection process	250
13.1	Chakib Khelil	578
15.1	Sample of Gazprom's international activities	681
15.2	Major Gazprom projects	686
16.1	Most significant divisions and subsidiaries of NNPC	702
19.1	Some key Sonangol subsidiaries and joint ventures	862

xvi



Contributors

Adilson de Oliveira, Federal University of Rio de Janeiro

Ifeyinwa M. Emelife, Stanford University

John P. Entelis, Fordham University

Patrick R. P. Heller, Revenue Watch Institute

David R. Hults, Stanford University

Benedicte Tangen Istad, Petroleum Resource Group AS

BinBin Jiang, Yale University

Leslie Lopez, The Straits Times (Singapore)

Paasha Mahdavi, University of California, Los Angeles

Peter A. Nolan, Stanford University

Varun Rai, University of Texas at Austin

Inna Sayfer, Stanford University

Paul Stevens, Chatham House

Ognen Stojanovski, Attorney

Mark C. Thurber, Stanford University

David G. Victor, University of California, San Diego

Nadejda Victor, US Department of Energy

Christopher Warshaw, Stanford University

xvii



Acknowledgements

We began this project in 2007 during a period of growing speculation about the future of the oil industry and the national oil companies (NOCs) that are the industry's dominant actors. Our research group, the Program on Energy and Sustainable Development (PESD) at Stanford University, had just completed two major studies – one of the globalization of gas supplies and one of the experiences with power sector reform around the world. Both those studies pointed to the fact that politicians had a very hard time managing the political fallout from volatile energy prices, and the single most important factor explaining most energy prices was the behavior of the oil market. There was no shortage of economic models that purported to explain oil prices, but our team at PESD thought that the most important factors at work in the oil industry were just as likely to be political as economic. And the political forces that mattered most were likely to concentrate on NOCs since they controlled most of the world's oil reserves and production.

When we began this study, most of the existing research spoke of NOCs as a monolithic block and usually in pejorative terms. Analysts assumed that competitive, privately owned oil companies would always perform better than state enterprises. We weren't sure that claim was always correct. And in any case we didn't think that approach was useful. NOCs would not soon disappear from the scene – in fact, many analysts suggested the world was in the midst of a swing back to national control of key industries.

Our starting point was that NOCs weren't monolithic. There was huge variation in their behavior and performance. We were mindful that there was no shortage of hypotheses that claimed to explain why NOCs might vary, but there wasn't much systematic analysis that actually tested such ideas. This book is an effort – the largest and most systematic independent analysis of NOCs – to explain why they varied.

We developed our research methods in stages, and we are particularly grateful to colleagues who helped us test and refine those

xviii



Acknowledgements

xix

methods on the early case studies. Those included many students at Stanford Law School and Paul Stevens who was involved with a similar study at Chatham House. Howard Harris at McKinsey and many colleagues at BP patiently helped us understand the industry. Field visits and interviews in Abu Dhabi, Brazil, Mexico, and Norway were especially formative – thanks to the many people who helped arrange those and the follow up discussions, notably Michael Ohadi in Abu Dhabi; Adilson de Oliveira and Rogerio Manso in Brazil; Pedro Aspe and Andres Rozental in Mexico; and Ivar Tangen in Norway. We also benefited from the insights of Thomas Heller, professor at Stanford Law School, and Francisco Monaldi, who was in residence at Stanford's Hoover Institution for a time during this project and has been a source of wisdom about the political economy of NOCs.

Early in 2008 we held a two week "winter seminar" at Stanford on NOCs. Many of the case study authors attended the sessions along with outside experts who offered invaluable advice – Jeff Colgan, Howard Harris, Christine Jojarth, Saad Rahim, and Edgard Habib. A special thanks to Christian Wolf for sharing his econometric research on NOC performance.

Each chapter in this book has undergone individual peer review, and those reviewers are thanked in those chapters. In addition to the people already thanked, we are grateful to Valérie Marcel for reviewing multiple chapters and sharing her insights from having studied the Gulf region NOCs so carefully.

The project benefitted from terrific administrative and editorial support. Kathy Lung led a team at PESD that included Tonya McPherrin, Rose Kontak, Aranzazu Lascurain, Valerie Wang, Emily Wang, and Joyce Thomas. David Victor moved to UC San Diego near the end of this project and thanks Amanda Brainerd for administrative help and Linda Wong for keeping track of all the references. PESD is grateful, as always, for the ongoing support of BP, plc, and the Electric Power Research Institute (EPRI).

At Cambridge University Press thanks to the team of Chris Harrison and Philip Good, who have guided this project from the early days. Rob Wilkinson and Penny Harper were also of great help in the production process.

David G. Victor David R. Hults Mark C. Thurber

