Expert Dialogues

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Adjusting Forecasting Methods To the Needs Of The Telecommunication Sector

Examining Forecasting Methodologies To Assist And Support Operators In The Transition From A Regulated Environment To Deregulated Markets

ITU - International Telecommunication Union
Market, Economics and Finance Unit
in cooperation with
IIF - International Institute of Forecasters

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A Changing Environment

From a Monopoly Situation to Liberalized Markets

The Changing Telecom Environment (1/10)

In Europe, 1998 was a very important event because the European Telecom Industry has been entirely deregulated. The main effects and consequences were :

- Increasing number of operators, carriers and Internet providers in the deregulated markets
- Increasing (and aggressive) competition and new Alliances
- Explosion of new products and services
- Evolution of the Customer Choices and usages : From Telecommunication to Communication
- Falling Prices and Falling Revenue
- Pressure on Settlement Rates on Bilateral Routes

The Changing Telecom Environment (2/10)

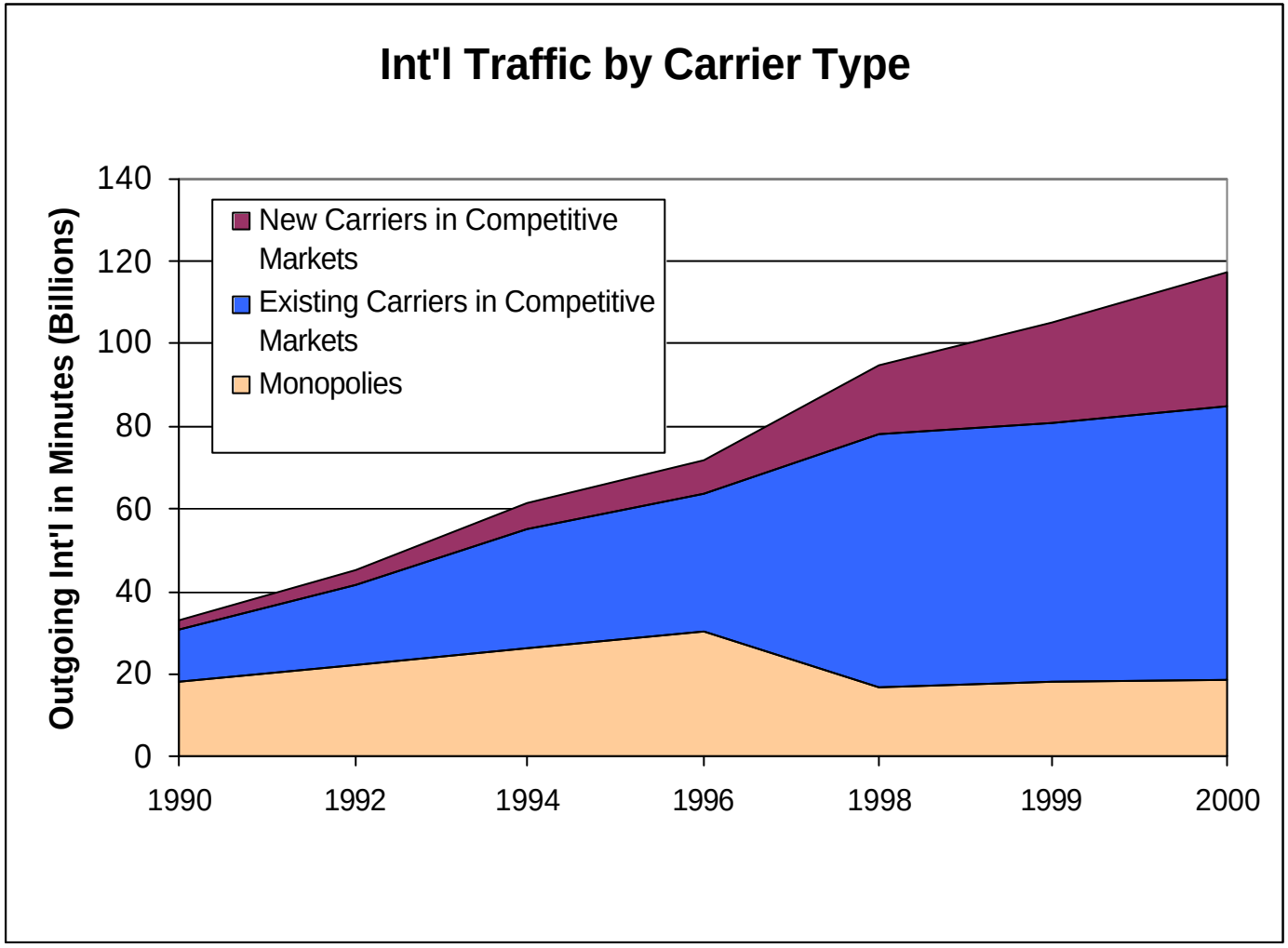
The Telecom Deregulation level

Regulation Index	1995	1996	1997	1998	1999	2000	2001	2002
Algerie	1	1	1	1	1	1	1	1
Allemagne	2	2	3	3	3	3	3	3
Autriche	1	2	2	2	3	3	3	3
Belgique	1	2	3	3	3	3	3	3
Bresil	1	1	1	1	1	1	1	1
Canada	2	2	2	2	3	3	3	3
Chine	2	2	2	2	2	2	2	2
Cote_d'ivoire	1	1	2	2	2	2	2	2
Danemark	3	3	3	3	3	3	3	3
Espagne_et_iles	2	2	2	2	2	2	2	2
Etats_Unis	5	5	5	5	5	5	5	5
Finlande	2	2	2	2	2	2	2	2
Grece	2	2	2	2	2	2	2	2
Hong_Kong	3	3	3	3	3	3	3	3
Irlande	2	3	3	3	3	3	3	3
Israel	2	2	3	3	3	3	3	3
Italie	2	2	3	3	3	3	3	3
Japon	2	2	2	2	3	3	3	3
Liban	1	1	1	1	1	1	1	1
Luxembourg	1	1	2	2	3	3	3	3
Maroc	2	2	2	2	2	2	2	2
Monaco								
Norvege	2	2	2	2	2	2	2	2
Pays_Bas	3	3	3	3	3	3	3	3
Pologne	1	2	2	2	2	3	3	3
Portugal	2	2	2	2	2	3	3	3
Roumanie	1	1	2	2	2	2	2	2
Royaume_Uni	4	4	4	4	4	4	4	4
Russie	2	2	3	3	3	3	3	3
Senegal	1	1	2	2	2	2	2	2
Suede	2	2	3	3	3	3	3	3
Suisse	1	2	2	3	3	3	3	3
Tunisie	1	1	1	1	1	1	1	1
Turquie	2	2	2	2	2	2	2	2
Yougoslavie	1	1	2	2	2	2	2	2
France	2	2	3	3	3	3	3	3

From 1 – Regulated markets to 5 – Fully Liberalized markets

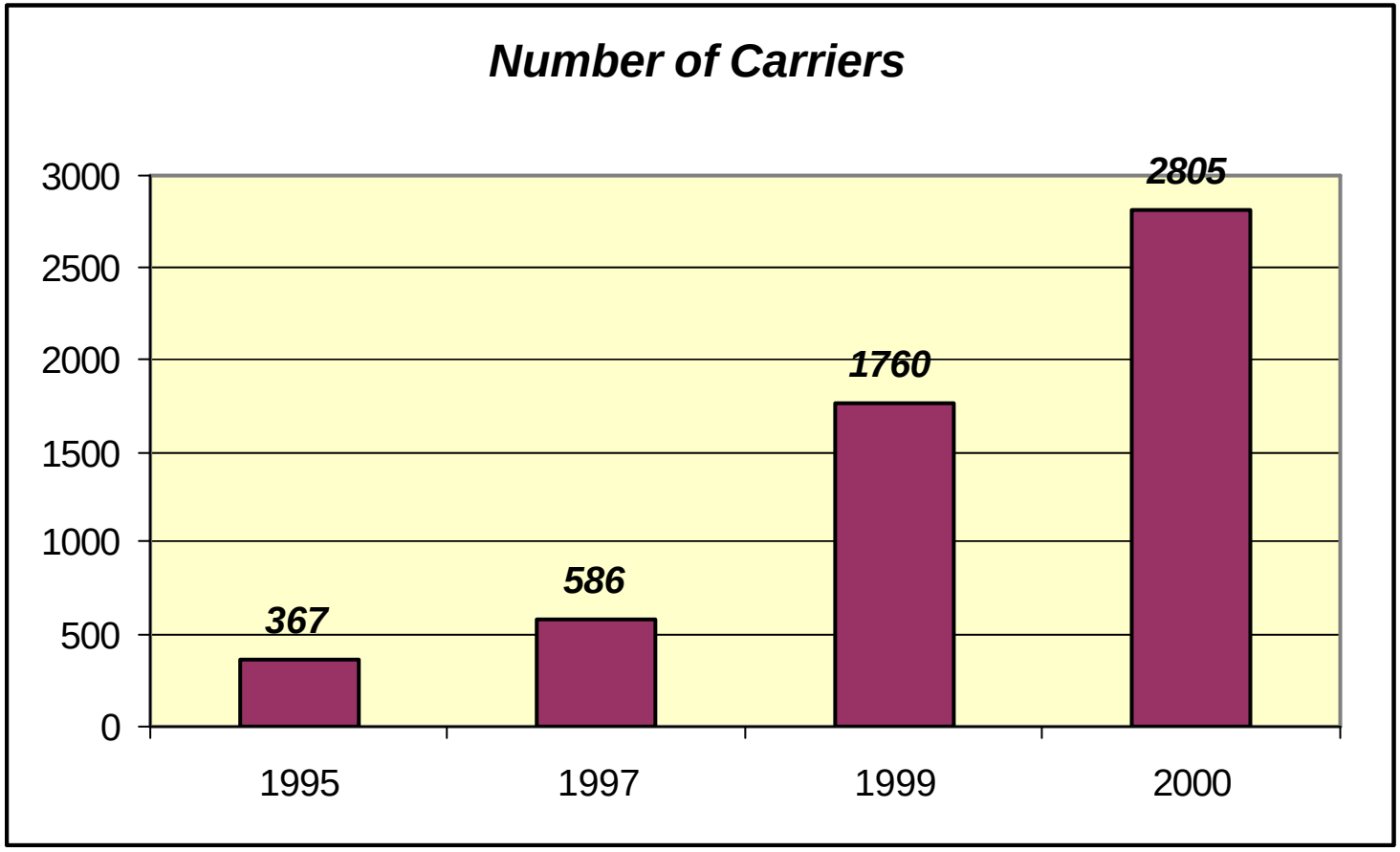
The Changing Telecom Environment (3/10)

- **Increasing and aggressive competition**



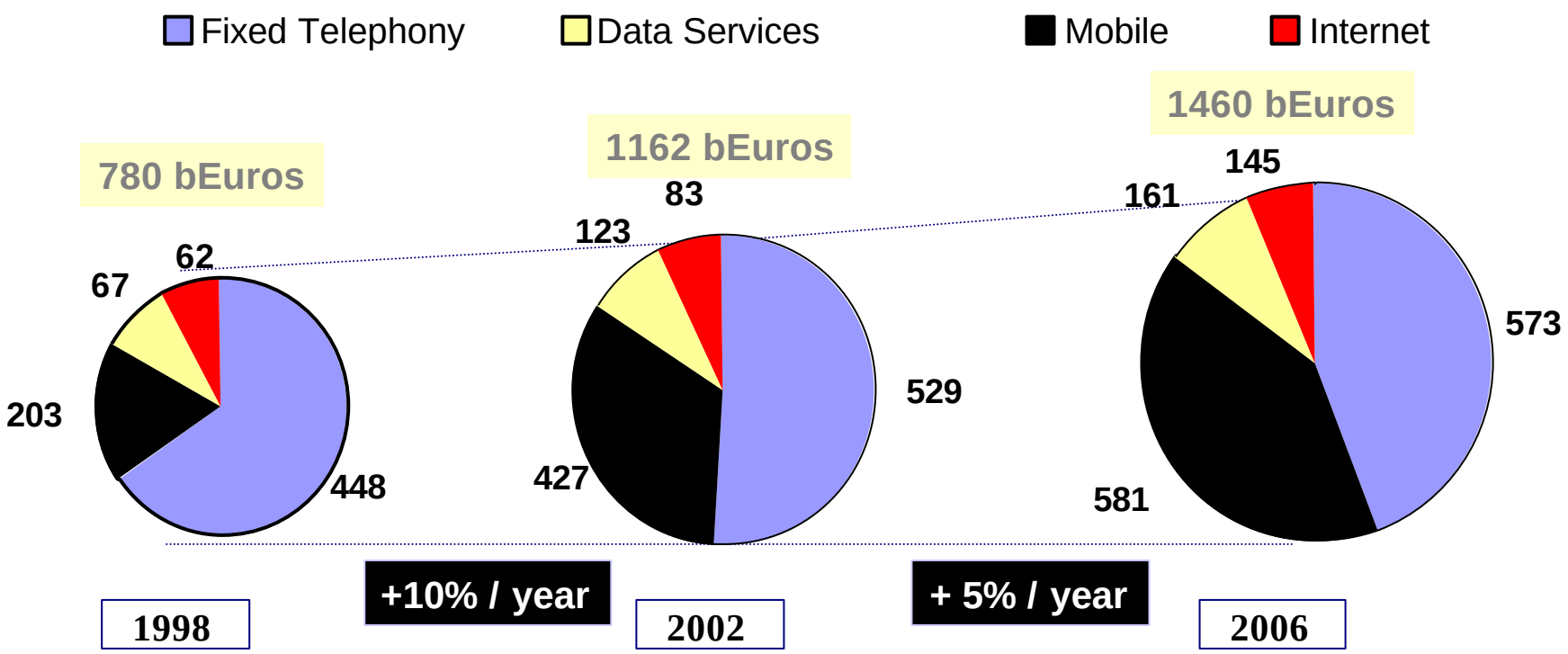
The Changing Telecom Environment (4/10)

- **The International Carrier Boom**



The Changing Telecom Environment (5/10)

- **A general overview of Worldwide Telecom Industry**



2005
1,2 billion of fixed lines
1,5 billion of mobiles
900 millions of Internet Access

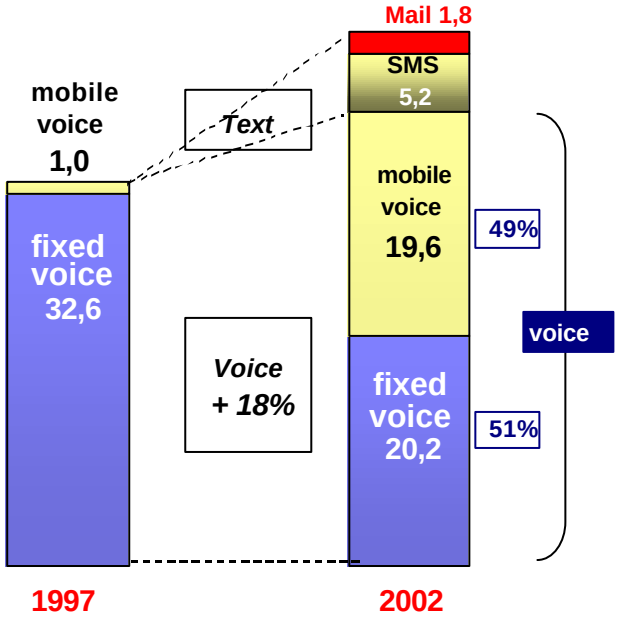
Source : Idate

The Changing Telecom Environment (6/10)

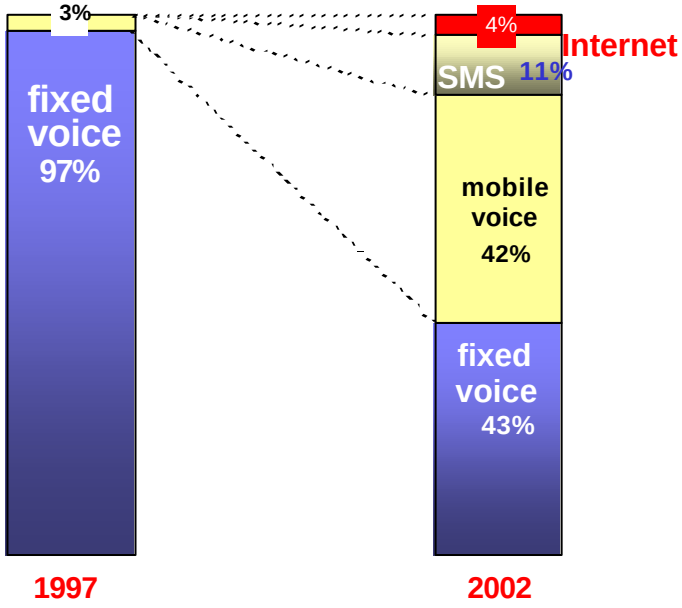
- **Explosion of new products and services**

  - **P2P Communications : + 40 %**
  - **Fixed Voice Calls : *only* + 18 %**
  - **Fixed Voice Share in the Global Call volumes falled**

Monthly Number of communication by FT's Customer



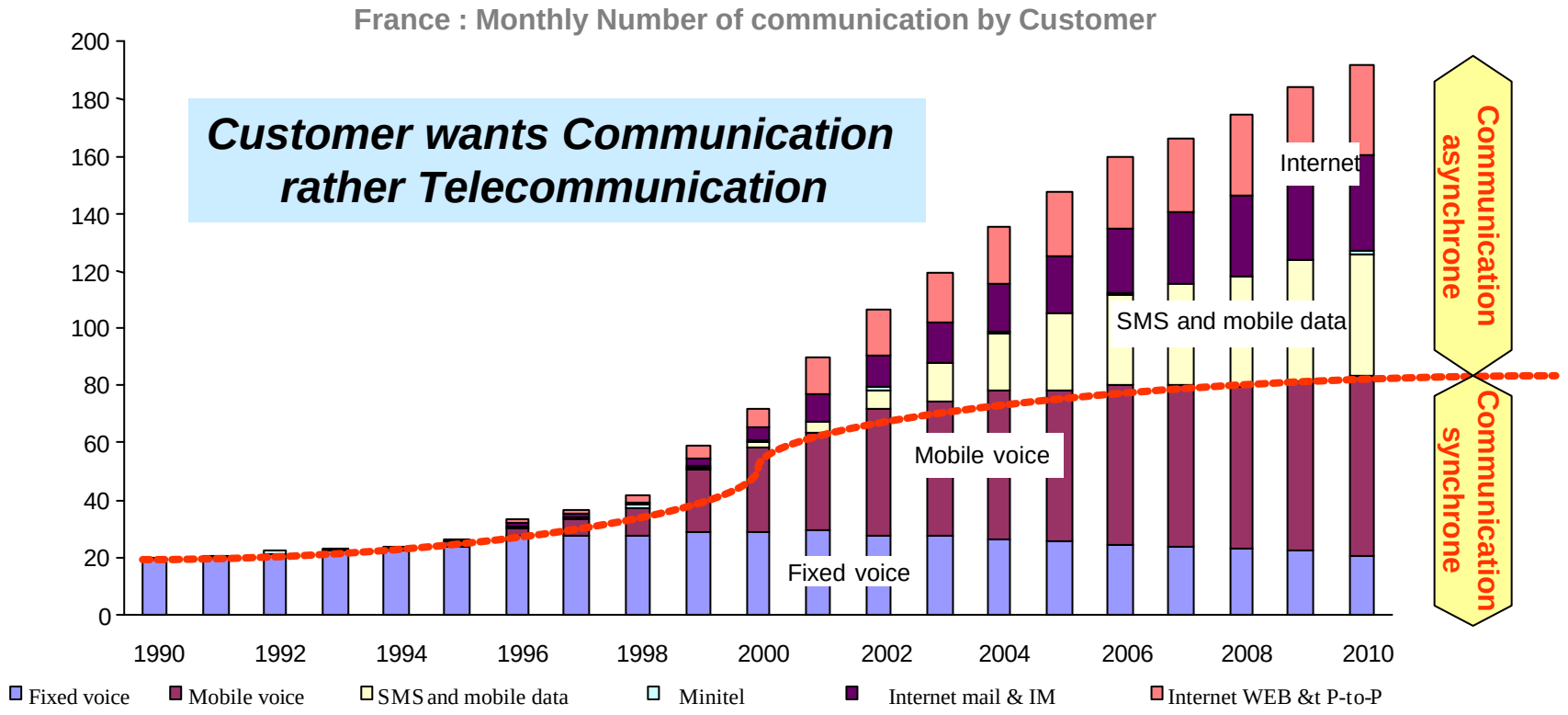
Structure of communications



Source : FT/DPS 2003

The Changing Telecom Environment (7/10)

Evolution of the Customer usages and Choices

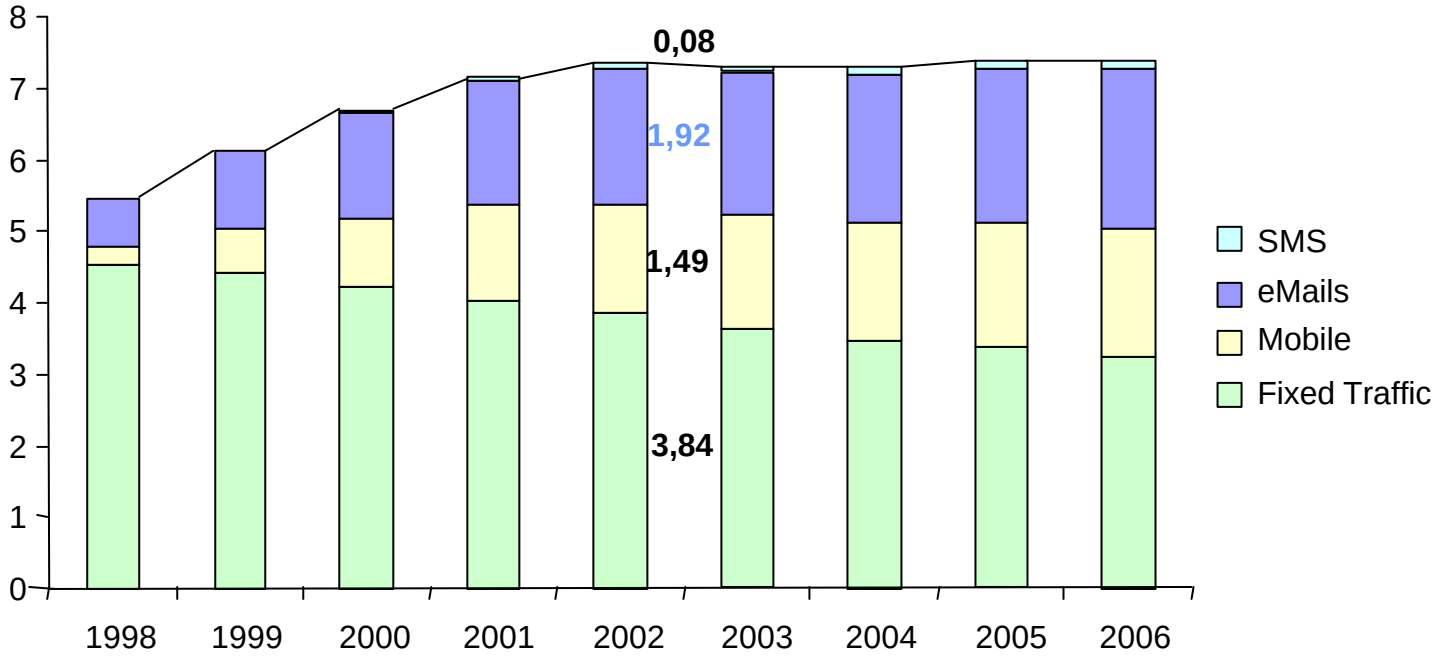


Source : FT/DPS 2003

The Changing Telecom Environment (8/10)

- **Evolution of the Customer usages in Enterprises**

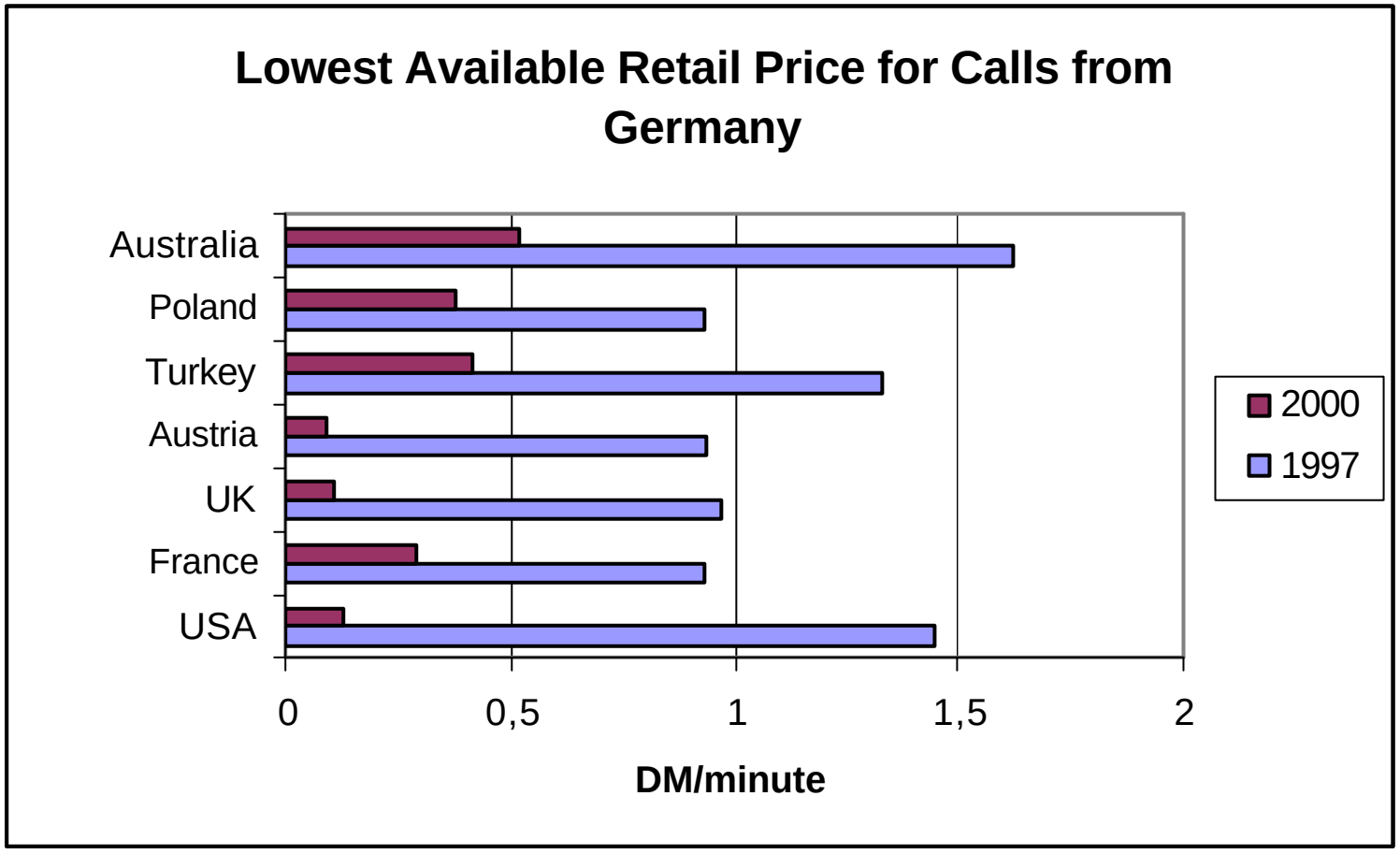
France : Number of communications by employee and by day



Source : FT/DPS 2003

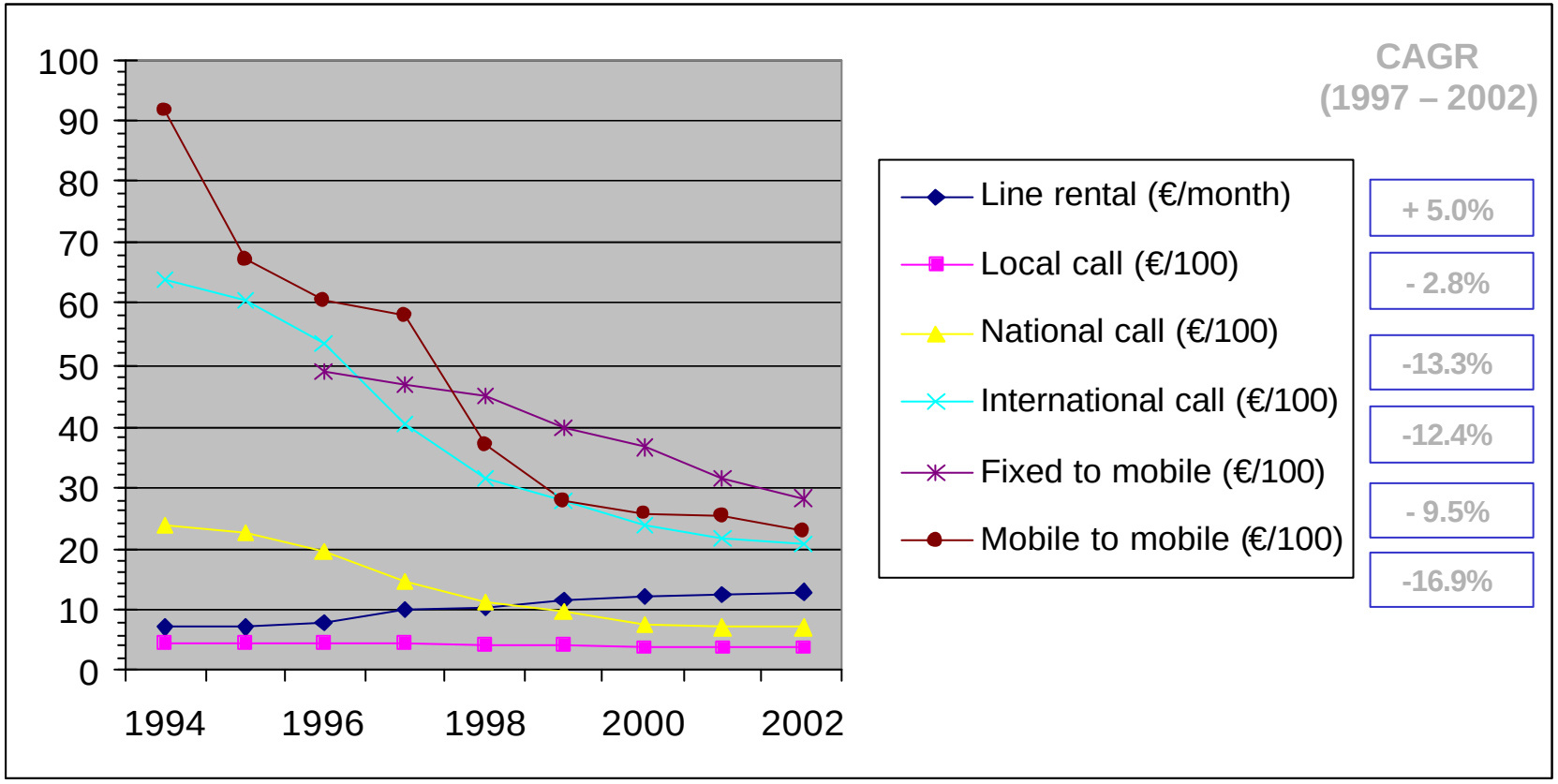
The Changing Telecom Environment (9/10)

- **Falling Prices and Falling Revenue**



The Changing Telecom Environment (10/10)

- **Price Evolution : France Telecom's Prices for Fixed Voice Traffic**



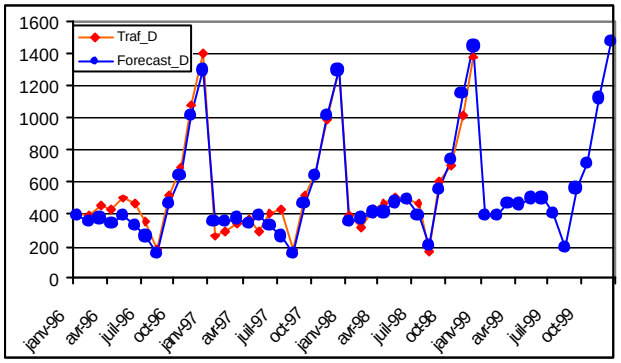
The Changing Telecom Environment : Conclusion

The Modeling and Forecasting Techniques in the Telecom Industry are significantly and highly impacted by this changing environment :

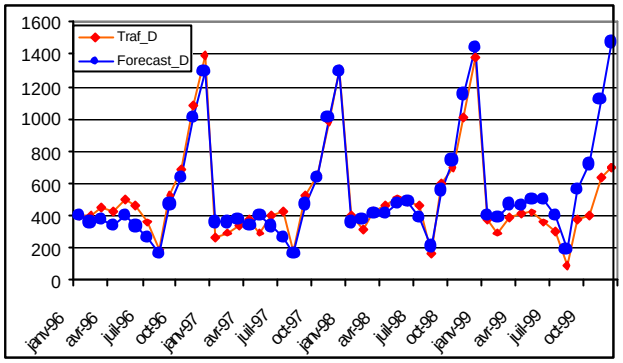
- It is necessary to Understand the real issues facing Operators in a newly Liberalized & deregulated environment
- These changes must lead the historical players (incumbents) to “re-engineer”, adapt and reshape their Forecasting processes and techniques to face and challenge the new environment
- These market changes must drive “new” and more suitable forecasting Techniques

Limitations of “Traditional” Forecasting Methods and Models in the Context of Competitive Markets

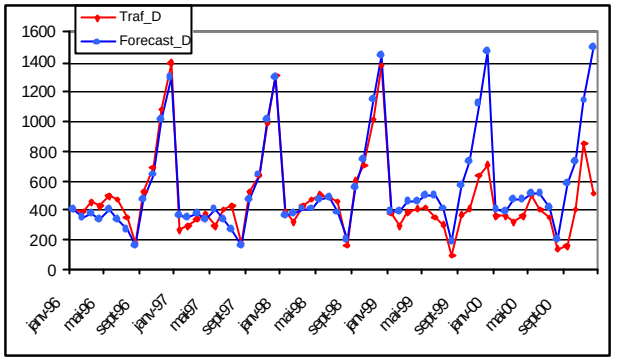
Using inadequate Forecasting Model : an example



Univariate B&J



Univariate B&J



Univariate B&J

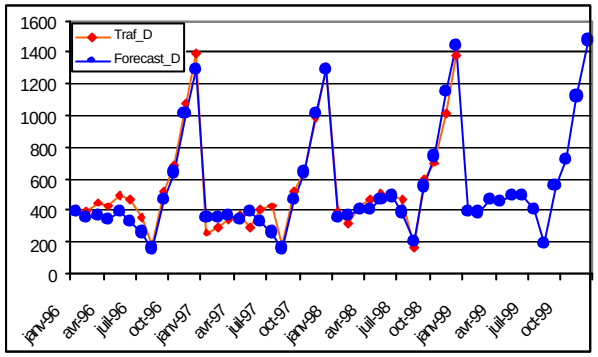
Monopoly situation → **Transition** → **Competitive Market**

- **Jan 1998 : Deregulation of Telecom Market**
- **Traffic Forecast for 1998 accurate.**
- **Forecasting Model = Univariate B&J for 1998**
- **Until early 1998 : Telecom environment was stable.**
- **In 1998 : Some New players entered the market**

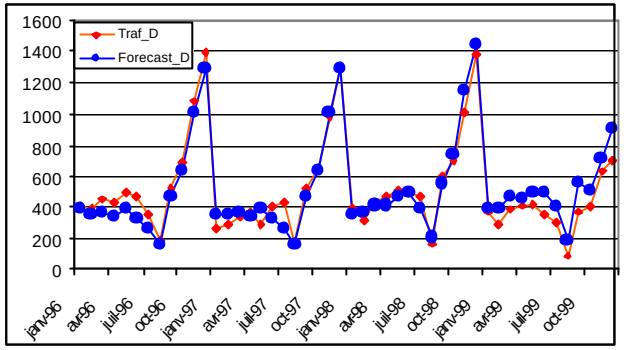
- **1999 : Deregulation of Telecom Market has produced its early effects**
- **Traffic Forecast for 1999 not accurate.**
- **Forecasting Model = Univariate B&J for 1999**
- **Starting 1999 : Telecom environment was instable because full competition**
- **In 1999 : Increase of the number of New players in the market**

- **2000 : Deregulation of Telecom Market has produced its full effects**
- **Traffic Forecast for 2000 not accurate et MAPE has shown an increasing error.**
- **Forecasting Model = Univariate B&J for 2000**
- **Very important change in the actual traffic**
- **In 2000 : Telecom market was widely opened and fully competitive**
- **In 2000 : Increase of the number of New players in the market**

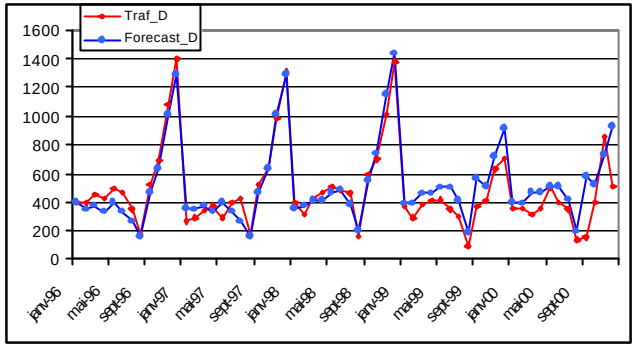
Adapting the Forecasting Model to the new context



Univariate B&J



Univariate B&J with Intervention Function
Hubbing & Refiling



Multivariate B&J Transfer Function
Prices, Competition, LCR

Monopoly situation

- **Jan 1998 : Deregulation of Telecom Market**
- **Traffic Forecast for 1998 accurate.**
- **Forecasting Model = Univariate B&J for 1998**
- **Until early 1998 : Telecom environment was stable.**
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Transition

- **1999 : Deregulation of Telecom Market has produced its early effects**
- **Traffic Forecast for 1999 accurate.**
- **Forecasting Model = Univariate B&J with Intervention Function for 1999**
- **Starting 1999 : Telecom environment was instable because full competition**
- **In 1999 : Increase of the number of New players in the market**

Competitive Market

- **2000 : Deregulation of Telecom Market has produced its full effects**
- **Traffic Forecast for 2000 accurate et MAPE has shown a stable error.**
- **Forecasting Model = Multivariate B&J for 2000**
- **The new model feets well the changing trend of traffic**
- **In 2000 : Telecom market was fully competitive**
- **In 2000 : Increase of the number of New players in the market**

The Selection of the Explanatory Variables

Main drivers in a Monopoly situation

The *main drivers* in a Monopoly Telecom market are the Economy and the Customer features :

Economy **: GNP, GDP, Income, Consumption, Price index, Investments, Foreign Trade …**

Customer **: demand, segmentation, price elasticity by customer segment, ….**

The main drivers in a *Competitive* Telecom market are :

Economy

Customers *needs and their perceived value, detailed segmentation, …*

Regulation *interconnexion rules, offerings*

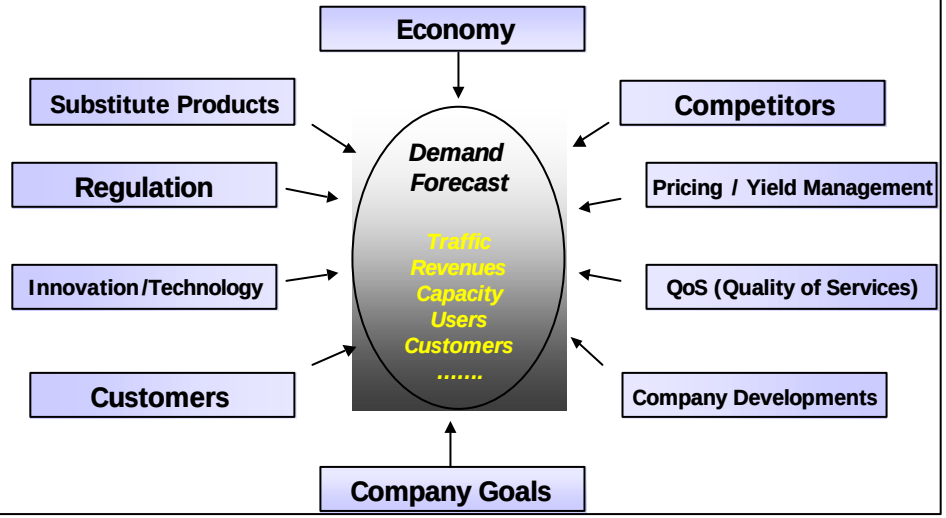
Pricing Strategy *adaptative pricing, yield management*

Competition, *market shares, players, …*

Product substitution

Technology & Innovation

Main drvers in a Competitive Environment



The Main Forecasting Methods used Before the 1998 Liberalization

- **An Example of a Previous Econometric Model used for the Global Outgoing IDD Traffic**

Explanatory Variable	Coefficient	Stand. Error	t-Statistic	Prob.
LOG(Price)	-0.471823	0.013197	-35.75160	0.0000
LOG(Time)*LOG(Price)	0.048264	0.003987	12.10482	0.0000
LOG(Foreign Trade)	0.477754	0.001810	263.9157	0.0000
AR(1)	0.373937	0.090575	4.128461	0.0001
R2	0.984826			
Adj. R2	0.984320			
Durbin-Watson	2.369308			

- **Before 1998, this type of Econometric model has generally provided accurate forecasts :**
  - For Global Traffic
  - For Main Customer Segments : Business and Residential
  - For Main Geographical Segmentation : Europe, Asia, NA, …
- **For regulated markets, this type of Econometric model could provide accurate forecasts :**
  - By country (Algeria, Viet-Nam, Cambodia, China, Saudi Arabia, Tunisia, …)
  - By area : Middle East, North Africa, South America, …

The Main Forecasting Methods used Before the 1998 Deregulation

- **An Example of Previous Forecasting Models by Geographical Segments for Global Outgoing IDD Traffic**

Geographical Segments	*Models/Methods used*	*Explanatory variables*
NAFTA USA-CANADA-MEXICO	Econometric Multivariate ARIMA *Market model*	Imports/Exports index Call prices communication consumption *Competition, Hubbing Refiling*
Western Europe	Econometric Uni/Multivar. ARIMA *Market model*	Imports/Exports index GNP/GDP - Call prices communication consumption *Competition Hubbing Refiling*
Japan/HongKong **Taiwan/S.Korea**	Econometric Univariate ARIMA *Market model*	Imports/Exports index GNP/GDP - Call prices communication consumption
South America	Econometric/Dynamic Reg. Uni.ARIMA/H&W *Market model*	Imports/Exports index GNP/GDP - Call prices communication consumption
Middle East/Africa	Econometric/Dynamic reg. Uni. ARIMA/H&W *Market model*	Imports/Exports index GNP/GDP - Call prices Global investments in ME
Caribbean (ex. Martinique & Guadeloupe)	X11 Regression / H&W *Market model*	Tourism index GNP/GDP - Call prices

The Forecasts Accuracy

- **An Example of a Previous Econometric Model for the Global Outgoing IDD Traffic**

	Estimated			Actual		
	1997	1998	1999	1997	1998	1999
Algerie	10,6%	12,5%	6,1%	11,2%	9,7%	7,2%
Allemagne	5,2%	18,9%	14,7%	4,8%	11,2%	9,2%
Autriche	2,3%	12,7%	13,8%	3,9%	9,2%	9,4%
Bresil	20,7%	4,8%	4,3%	17,2%	7,2%	1,2%
Canada	18,3%	15,9%	13,9%	15,2%	11,2%	8,2%
Chine	20,7%	14,9%	12,1%	19,4%	13,2%	14,6%
Etats_Unis	11,2%	21,3%	14,8%	9,1%	12,4%	8,1%
Grece	6,3%	9,4%	9,1%	9,2%	11,2%	12,4%
Irlande	14,7%	26,8%	14,9%	11,8%	17,0%	17,2%
Italie	5,8%	11,4%	14,6%	4,5%	9,2%	8,6%
Japon	2,0%	3,5%	9,2%	1,9%	2,1%	1,8%
Maroc	10,9%	26,7%	9,1%	11,9%	24,0%	12,7%
Pologne	19,6%	15,9%	11,0%	12,8%	14,8%	14,2%
Portugal	11,2%	26,5%	9,4%	10,2%	19,2%	7,1%
Royaume_Uni	19,8%	23,0%	12,7%	15,4%	11,4%	5,7%
Russie	13,5%	19,2%	13,4%	9,2%	14,3%	11,2%
Senegal	5,4%	17,3%	12,6%	8,2%	14,1%	14,9%
Suede	22,7%	11,8%	15,6%	19,8%	5,1%	5,7%
Suisse	8,9%	11,6%	18,4%	7,9%	9,5%	7,9%
Turquie	15,9%	12,7%	9,9%	14,5%	13,6%	7,6%

Enhancing the Modeling Process (1/4)

The Econometric Modeling

- To enhance the quality of the forecast (accuracy)

- To have a better comprehension and understanding of the *Market Structure :*
  - ➢ *for example, how each explanatory variable drive the demand ?*

- To learn the relationship between the dependent variable (to be forecasted) and its environment : evaluation of the Economy, Price, Competition, … impacts on the dependent variable (contribution)

- To assess and test and simulate some alternative scenarios and hypothesis :
  - ➢ *For example, what is the impact on mobile voice traffic of 15% reduction of price ?*

- To catch the dynamic of the market environment (lagged explanatory variables)
  - ➢ *For example, when (after how many months or weeks) a 10% reduction of price will increase the demand ? This could allow the operator to adapt the periodicity of some actions through the time (special offers, …)*

Enhancing the Modeling Process (2/4)

Time series Modeling

• We can integrate in some Time Series Models the effects of :

- *specific actions/events (dummy variables, intervention variable)*
- *Multivariate Time Series Analysis : including explanatory variables (Transfer Function Modeling, i.e Box & Jenkins with Transfert function or Kalman Filtering)*

Growth Curves/S-Curves

• These models are adequate for new product studies

- *The Logistic (Local, Extended, …)*
- *Gompertz*
- *Exponential*

Enhancing the Modeling Process (3/4)

■ **A specific Model for each Customer Segment : by customer, by market, by product, ...**

For example :

- *By Age*
- *By Income*
- *By Occupation*
- *By overall Spend*
- *By business sector*

The benefit is to learn for example how each Type of Customer reacts to the Price, Economic, Competition … variables

- For example, the Young Customer has a high Price elasticity . The « High Revenues » Customer has a high Economy elasticity than Price elasticity.

- This information could help the operator for its Marketing strategy (Packages for Young Customers, Prepaid cards for…..)

Enhancing the Modeling Process (4/4)

The need of Information and Data in the Competitive markets

There is a very important need of onformation and data concerning « new » drivers to be considered in a competitive market :

- **Competition**
- **Innovation**
- **Pricing**
- **Regulation**
- **Customer attitudes and choices**
- **QoS**
- **Substitution Products**
- **Marketing**
- **Strategy**
- **Sales**

How to collect them :

- **Market intellingence**
- **Benchmark studies**
- **Consultancy sources :** *Ovum, IDC, Giga, Yankee Group, Idate, Frost& Sullivan, ……*
- **Customer surveys / Trade Off studies**
- **Int'l Offices os Statistics :** *ITU, WB, IMF, EU,*
- **National Offices os Statistics :** *INSEE, Census, …*
- **Other sources :** *Wefa, ….*

➢***It is absolutely important to improve the « quality » of the Data to be integrated in the forecasting models***

➢***It is « vital » to track « new » information concerning the competitive market***

Limitations of traditional forecasting methods : Conclusion

The Forecasting Process (Modeling, Estimating, Accuracy) must be adapted continuously to the changing environment :

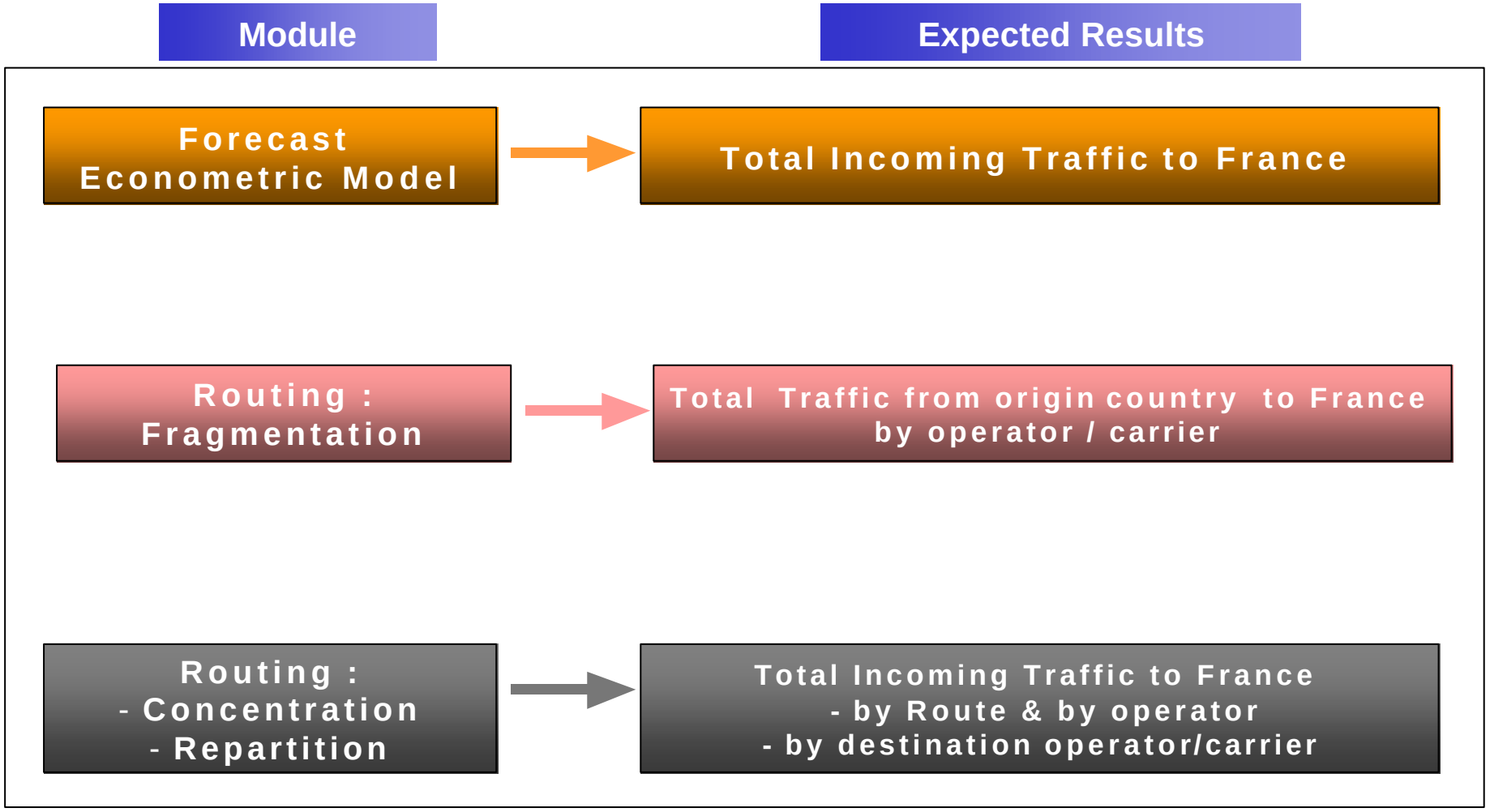
- The market changes must drive "new" and more adequate forecasting Techniques (for example the Simultaneous Equation Models)
- Telecom Forecasting Models must take into account :
  - More adequate and accurate explanatory variables
  - The dynamic of demand and supply : lagged variables
  - The Necessity of more detailed Demand Segmentation
  - The Players behaviour and Strategies (Alliances, …)
- Using Econometric Models solely could lead to inconsistent and not accurate Forecasts :
  - It is necessary to integrate in the Forecasting Process other contributions outside the Econometric Model (see Case Study in 3rd Part) : Learning from Customer Surveys, Market Studies, Trade Off studies, … ***and experience***
  - Integrating a flexible pricing strategy : stable Price elasticity ?
  - Learning from the experience of deregulated and competitive telecom markets : UK, USA, …
  - Need for frequent re-forecasting and adaptative forecasts
  - Integrating new traffic routing strategies (LCR, hubbing, refiling,…)

A Case Study from an important Operator Experience in the International Traffic

Outlining the Forecasting Methods undertaken and how they held up to the Challenges of Liberalization in 1998

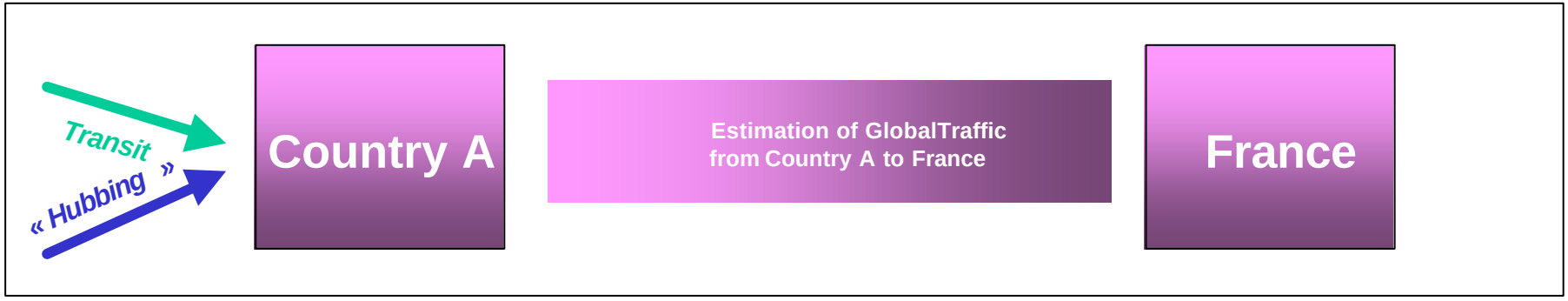
Adoption of New Approaches and Forecasting Models

- **Building a new approach for Incoming International Traffic (IDD Traffic)**



Forecasting the Int'l Incoming Traffic (1/9)

- **Module 1 : Global Traffic between Origin country and France :**
  - ***"Traditionnal" Econometric Modelling & Estimation***
  - ***But with More suitable explanatory variables***



- **Transit & "hubbed" traffics to country A are not included in the Global traffic**
  - ***They should be added outside the model***

Forecasting the Int'l Incoming Traffic (2/9)

- **Information & Data Set :**
  - Annual Data from 1990 to 1998
  - Traffic between 54 countries , i.e 9 years x 54 countries x 53 country-pairs
- **Model Specification & Estimation**

Récapitulatif du modèle

Modèle	R	R-Square	Adj. R-Square	Erreur standard de l'estimation	Durbin-Watson
1	0,92	0,84	0,84	0,66	1,74

Variable dépendante : Ln (Outgoing Traffic)

Coefficients / Modèle	Coefficients non standardisés		Coefficients standardisés	t	Significat°
	B	Erreur standard	Bêta		
(constante)	-1,362	0,7905		-1,7227	0,0852
Ln (Minimum Population)	0,268	0,0276	0,1614	9,7080	0,0000
Ln (Origin GDP per capita)	0,220	0,0252	0,1551	8,7370	0,0000
Ln (Destination GDP per capita)	-0,270	0,0469	-0,0672	-5,7539	0,0000
Liberalisation Dummy for Origin	1,615	0,1357	0,1531	11,8995	0,0000
Liberalisation Dummy for Destination	0,860	0,1204	0,0939	7,1433	0,0000
Language Similarity Measure (All Languages)	0,741	0,0663	0,1525	11,1790	0,0000
Ln (Distance)	-0,193	0,0377	-0,1347	-5,1197	0,0000
Time Difference (Hours)	-0,008	0,0114	-0,0168	-0,6974	0,4857
Colonisation Dummy	0,397	0,1006	0,0471	3,9476	0,0001
Ln (Total Route Trade)	0,589	0,0209	0,5573	28,1531	0,0000
Ln (Absolute (Origin Population - Destination Population))	0,096	0,0145	0,1031	6,6415	0,0000
Ln (Absolute (Origin GDP per capita - Destination GDP per capita))	0,066	0,0173	0,0483	3,8489	0,0001
Ln (Tariff of Origin Country)	-0,460	0,0571	-0,1645	-8,0463	0,0000

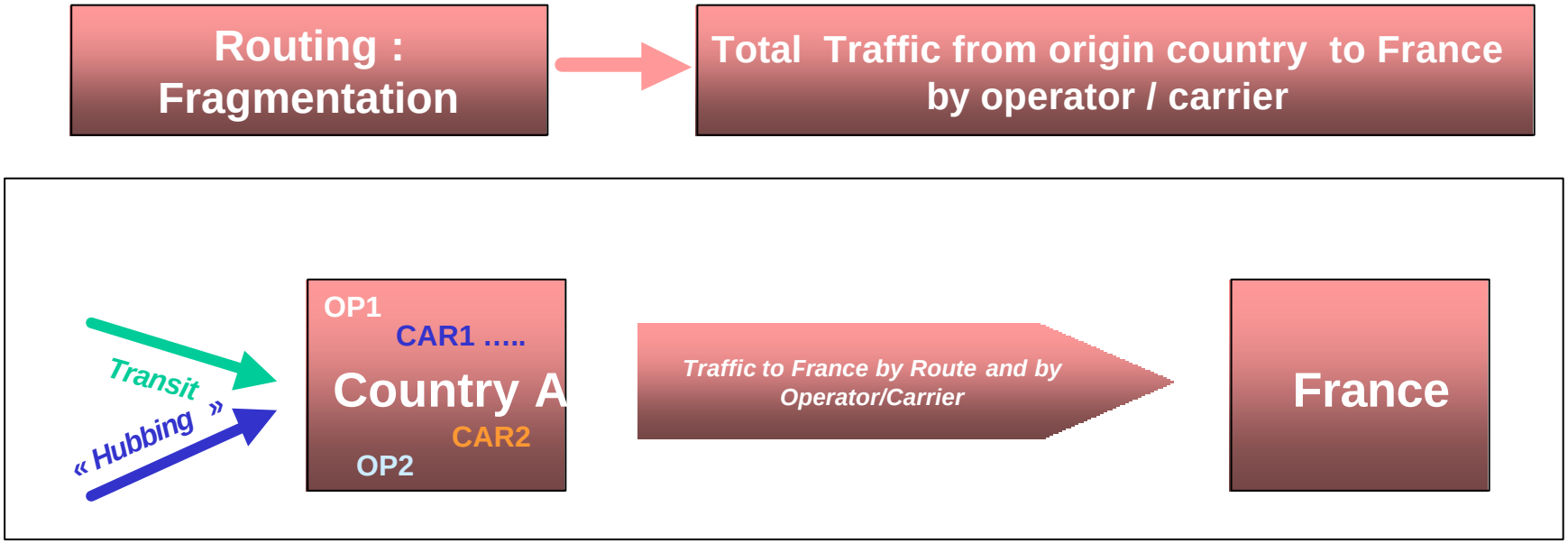
Forecasting the Int'l Incoming Traffic (3/9)

Actual & Predicted data

	Actual traffic (millions minutes)				Predicted Traffic						Difference			
Country	95	96	97	98e	95	96	97	98	99	00	95	96	97	98
Algerie											10%	-3%	-1%	1%
Allemagne											6%	14%	6%	8%
Autriche											3%	-1%	11%	4%
Belgique											-1%	-1%	11%	11%
Bresil											1%	-13%	-7%	-30%
Canada											14%	10%	-10%	12%
Chine											-4%	-9%	-2%	-5%
Cote_d'ivoire											-5%	15%	-14%	-2%
Danemark											7%	12%	17%	28%
Espagne_et_iles											5%	4%	10%	16%
Etats_Unis											-4%	-7%	8%	18%
Finlande											-8%	4%	5%	-8%
Grece											6%	8%	-2%	-5%
Hong_Kong											34%	18%	41%	95%
Irlande											0%	-6%	5%	-2%
Israel											9%	6%	-3%	6%
Italie											11%	-5%	5%	1%
Japon											5%	18%	5%	-1%
Liban														
Luxembourg											2%	-3%	1%	-13%
Maroc											1%	19%	22%	5%
Monaco														
Norvege											14%	14%	1%	-28%
Pays_Bas											-4%	13%	10%	-16%
Pologne											8%	-9%	-2%	-9%
Portugal											1%	2%	3%	-3%
Roumanie													-3%	-23%
Royaume_Uni											5%	4%	-8%	-7%
Russie													0%	11%
Senegal											-8%	-4%	10%	14%
Suede											3%	19%	-1%	-34%
Suisse											4%	6%	-2%	3%
Tunisie											4%	-2%	5%	-8%
Turquie											-6%	-7%	0%	-11%
Yougoslavie														
Western Europe Total											4%	5%	3%	0%
Total											3%	3%	1%	0%

Forecasting the Int'l Incoming Traffic (4/9)

- **Module 2 : Fragmentation of the Incoming Traffic from Origin Country to France :**



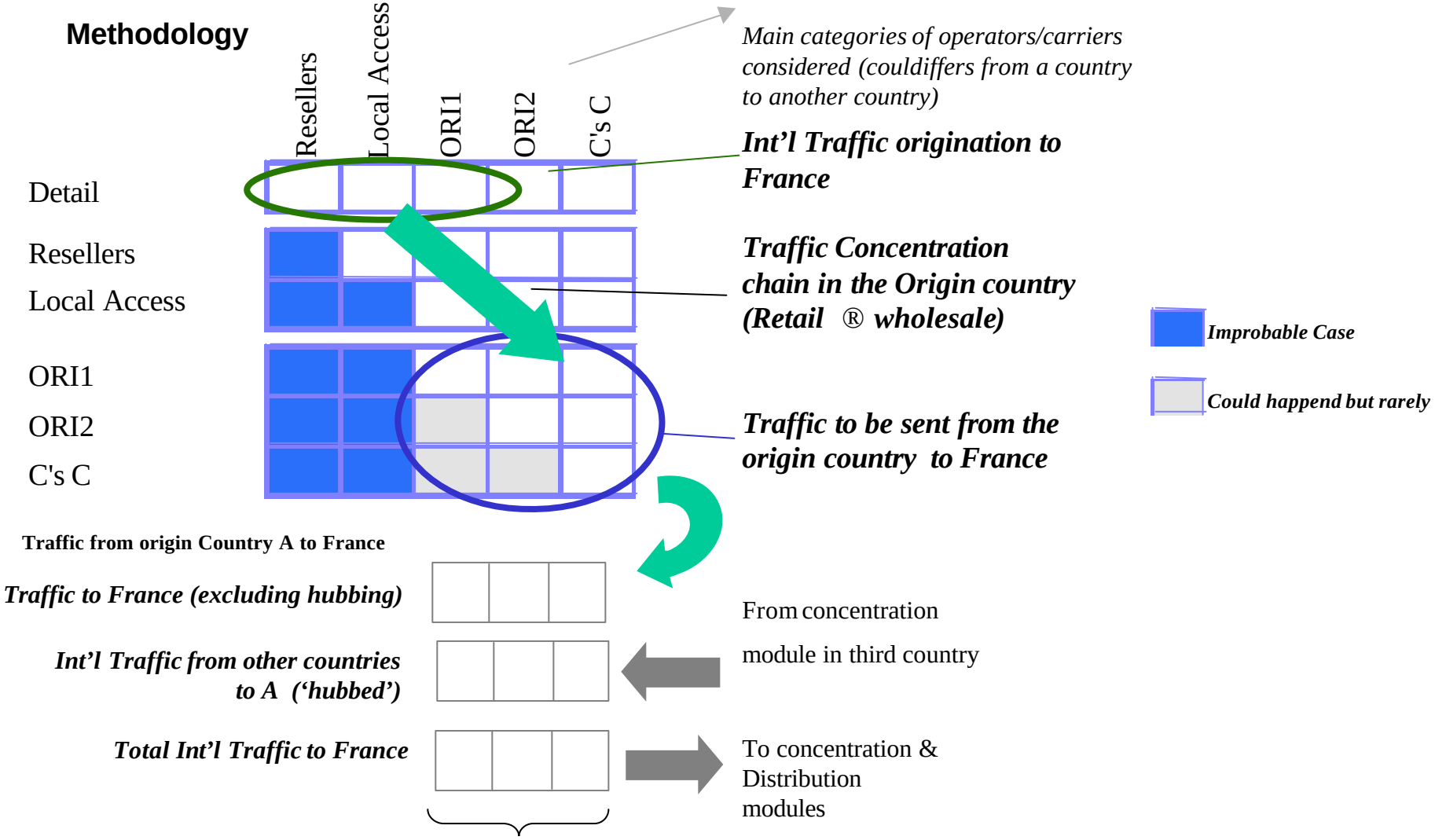
- **Transit & "hubbed" traffics to country A by Route and by Carrier/Operator must be added to the global Traffic**

- **Assumptions and hypothesis are defined for actual and future situation of players & market :**
  - ***Alliances and Partnership Policy***
  - ***Liberalization evolution and Telecom players behaviour in the origin country***

Forecasting the Int'l Incoming Traffic (5/9)

Fragmentation of Traffic in the Origin Country

Methodology



Forecasting the Int'l Incoming Traffic (6/9)

- **Fragmentation of Traffic in the Origin Country**

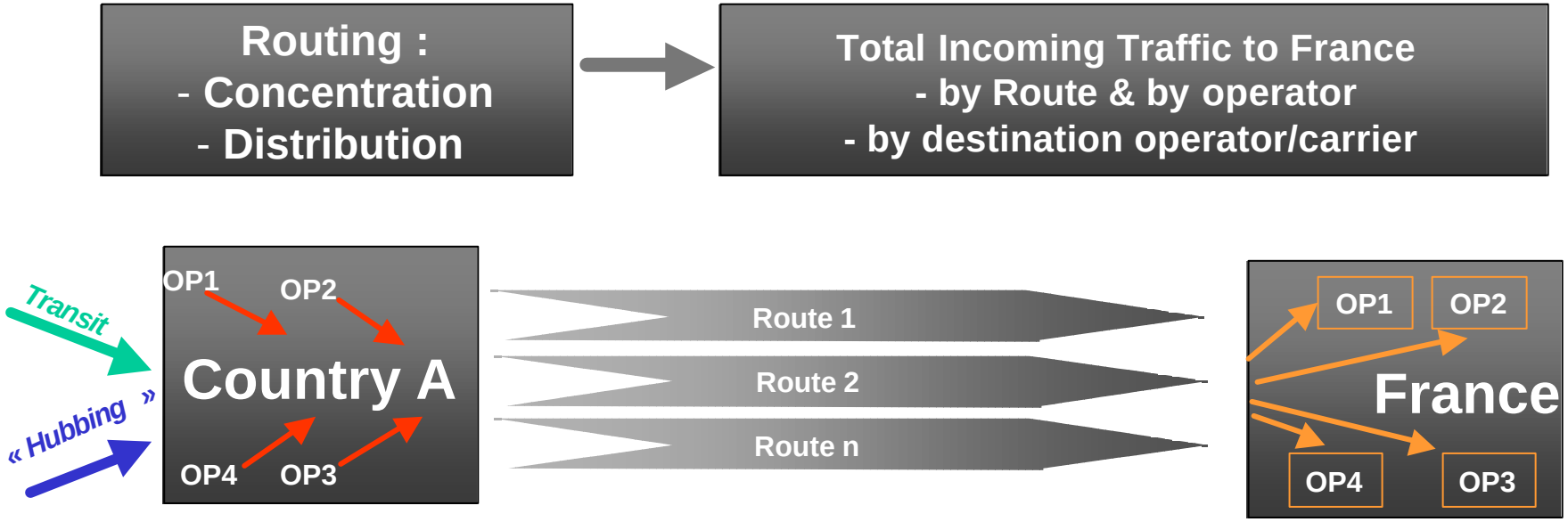
	Resalers	Local Access	National Carrier (excluding Int'l)	BT	Mercury (C&WC)	WorldCom	Global One	CsC	Others
Détail	15%	6%	10%	50%	17%	1,0%	0,5%	1,0%	0%
Resalers		0%	0%	5%	35%	20%	5%	15%	20%
Local Access			0%	5%	55%	10%	5%	10%	15%
National Carrier (excluding Int'l)				15%	45%	20%	5%	5%	10%
BT				100%	0%	0%	0%	0%	0%
Mercury (C&WC)				0%	100%	0%	0%	0%	0%
WorldCom				0%	0%	100%	0%	0%	0%
Global One				0%	0%	0%	100%	0%	0%
CsC				0%	0%	0%	0%	100%	0%
Others									100%

TOTAL

Détail
Resalers
Local Access
National Carrier (excluding Int'l)
BT
Mercury (C&WC)
WorldCom
Global One
CsC
Others

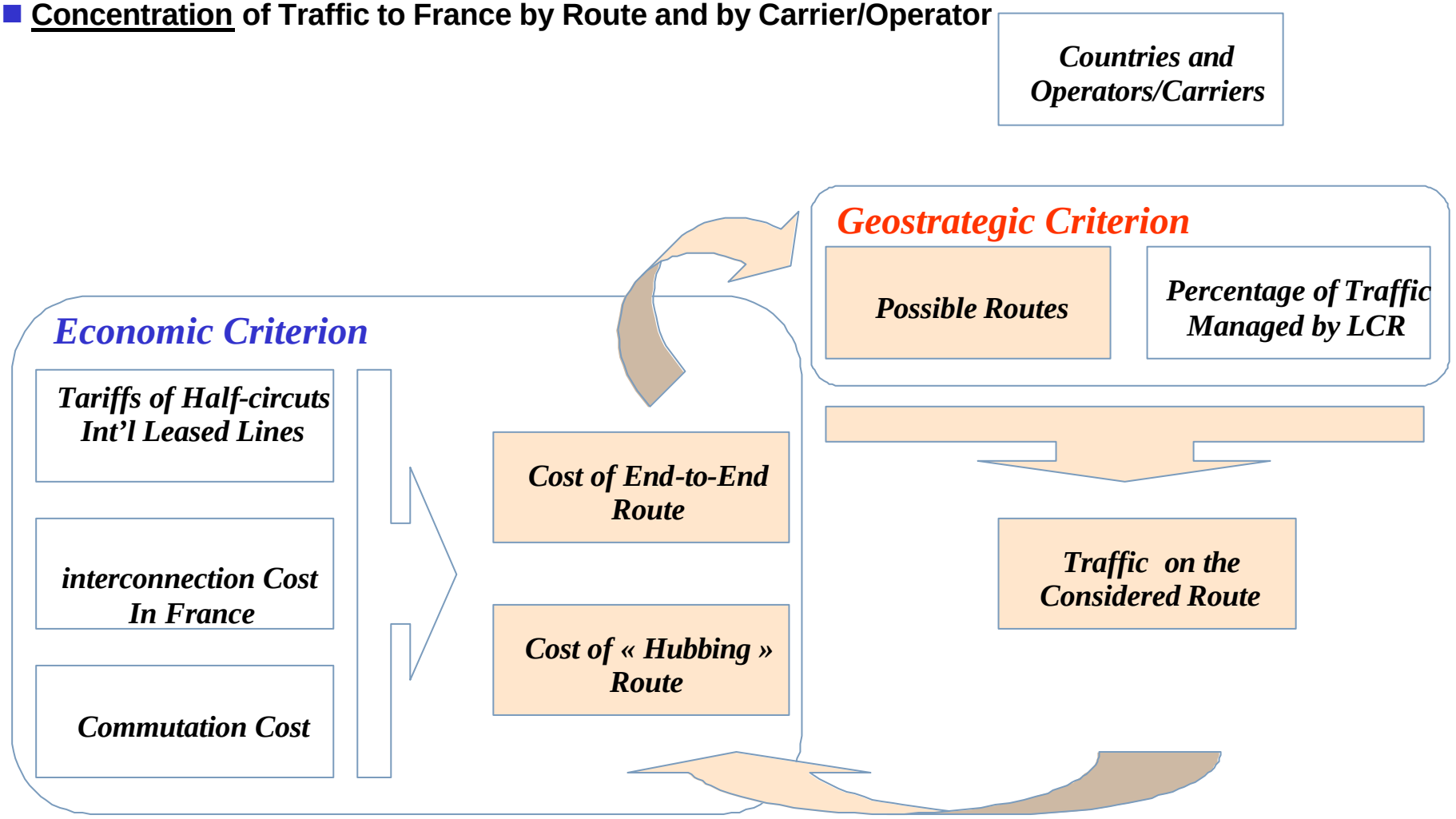
Forecasting the Int'l Incoming Traffic (7/9)

- **Module 3 : Traffic Concentration in the Origin Country & distribution in France**



Forecasting the Int'l Incoming Traffic (8/9)

- **Concentration of Traffic to France by Route and by Carrier/Operator**



Forecasting the Int'l Incoming Traffic (9/9)

- **<u>Distribution</u> of Int'l Incoming Traffic to France by Carrier/Operator**

Operator Traffic	Traffic on Operator bilateral route + Traffic on « Third » party bilateral route + End to End Traffic (if Affiliated)
Competitors Traffic	Traffic on the Carrier's bilateral route + Traffic on « Third » party bilateral route + End to End Traffic (if partnership)

Conclusion

Conclusion :

The Forecasting process (modeling, estimating, accuracy checking) must be adapted continuously to the changing environment :

- **The market changes must drive "new" and more adequate forecasting Techniques**
  - **"Refresh" the forecasting model & approaches**
  - **Build alternative model & approaches when necessary**
  - **Use alternative scenarios to assess the demand & supply**
- **Telecom Forecasting Models must take into account :**
  - **More adequate explanatory variables**
  - **The dynamic of demand and supply : lagged variables**
  - **The Necessity of Demand Segmentation**
  - **The Players behaviour and Strategies (Alliances, …)**
  - **The flexibility of pricing strategy**
  - **New traffic routing strategies (LCR, hubbing, refiling,…)**
- **It is necessary and very useful :**
  - **to integrate in the Forecasting Process other contributions outside the Econometric Model : Learning from Customer Surveys, Market Studies, Trade Off studies.**
  - **To learning from the experience of deregulated and competitive telecom markets : UK, USA, Australia, Canada, …**
  - **To set-up and use a re-forecasting process**

THANK YOU FOR YOUR ATTENTION

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