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Roadmapping 3G mobile TV: Strategic thinking and scenario planning through repeated cross-impact handling

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ABSTRACT

In order to deal with growing uncertainties emerging in the 3G wireless industry and to preserve their competitiveness, managers involved in the wireless value network should identify future success very early and develop their strategic planning on time. This study, based on a Scenario Evaluation and Analysis through Repeated Cross impact Handling, allows the generation of both qualitative and quantitative scenarios and can be used as an operative planning tool. The dynamic forces driving the scenario are based on the main principles of system thinking and multiple features. The probabilistic data have been elicited with the help of 40 executives in USA and Europe working for companies in the different phases of the wireless value chain. Findings allow to identify basic trends and uncertainties useful to develop corporate or business strategies.

1. Introduction

In order to deal with growing uncertainties emerging in the 3G wireless industry and to preserve their competitiveness, managers involved in the wireless value network should identify future success very early and develop their strategic planning on time. A valid concept of what the future could be implies the existence of an overall conjectural framework which makes full allowance for the dynamics and complexity of the various systems involved.

To address this objective companies need to develop a scenario management approach which aims to help them to manage this complex planning situation basing on intelligible description of a possible situation in the future characterized by a complex network of influence [1] that are adjusted precisely to their enterprises.

As most of the scenarios that have been constructed in the literature have little relevance to studies of real strategic planning, the scenario management approach adopted in this study includes the principles of systems thinking [2] and multiple futures in which enterprises must perceive their environment as a complex network of influence factors which are connected to each other. With reference to the 3G wireless industry we focus on complexity described by the trends of variety and dynamics [3]. Trend of variety refers to the rising growth of the number of relevant factors related to new technologies, standard globalization, political regulations, and growing expectation from customers. Trend of dynamics refers to the dynamics of the process of changes in the industrial environment. With specific reference to 3G mobile TV services we develop a scenario based on five project phases. Aim of this study is to provide a tool useful to develop corporate or business strategies and similar elements of these strategies, such as mission statements or core competencies.

Porter's scheme of the value chain [4] is used as a tool for strategic analysis. Different scenarios have different effects on the relative importance of the activities generating added value, the configuration of the chain, cost determinants, interrelations, the sustainability of sources of competitive advantage and the choice of base strategies.

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In the remainder of Section 2, we describe the purpose of the study. Section 3 describes the research design, philosophy and implementation; Section 4 describes the principal findings of the research and explains the key insights provided in the model; Section 5 presents a discussion of plausible scenarios; Section 6 presents the strategic analysis; and Section 7 provides a summary and conclusion.

2. Roadmapping and scenario planning

Roadmap is described in the literature as a visual tool that identifies and describes specific customer requirement-driven technology clusters and specifies potential discontinuities and critical requirements related to technology decisions [5]. As described by Albright and Kappel [6] roadmaps are the base for corporate technology planning, identifying needs, gaps, strengths and weaknesses in a common language across the corporation.

At both intra-organizational (department-level) and inter-organizational levels in technology and industry, roadmapping has become a fashionable alignment tool as it combines forecasts and business strategies.

There is a wealth of literature focusing on the functions, uses and tools of roadmaps in high-technology companies [6–25]. Product-technology roadmaps in the corporate settings are used to define the plan for the evolution of the product linking business strategy to the evolution of the product features and costs to the technologies needed to achieve the strategic objective [6]. They can serve as a foundation that enable company to respond to varying customer demands for new product features, functions and price points.

As suggested by Strauss and Radnor [5] roadmapping can become unwieldy when planning is challenged by change that is volatile and rapid, systemic and unanticipated. Roadmapping incorporates in fact technology trajectories and competitive environment inputs and it assumes a straight-line projection or single scenario.

To overcome this limitation strategic thinking and scenario planning are used to identify the nature, timing and implications of a range of changes allowing managers to enhance strategic planning and highlight the implications of possible future systemic discontinuities. Previous studies [5] support the perspective that roadmapping and scenario planning toolsets have the potential to provide operational and strategic-level managers with substantial assistance.

2.1. Approaches for scenario planning

Scenarios are described in the literature as general descriptions of future conditions and events [26,27,4,28], hypothetical futures expressed by means of a sequence of temporal images [29], a technique to analyze alternative futures and develop firm strategies [30–32].

Policy makers and corporate strategists, in a variety of industries, use scenarios to develop and test the robustness of new strategies against different futures [33]. Despite its successful employment at national and corporate levels, scenario analysis has rarely been used at an industry level where competitors and partners in the same or related sectors have come together to jointly develop narratives of the future.

There is a large number of approaches for scenario projects since scenario writing was established by Kahn and Wiener [34]:

- *Intuitive logics* [35–37], are based on scenario logics, which are organized themes, principles, or assumptions that provide each scenario with a coherent, consistent, and plausible logical underpinning;
- *Trend impact analysis* [38], are based on alternative projections of different key factors, which are combined to coherent, consistent, and plausible descriptions of the future;
- *Cross-impact analysis*, are based on techniques designed to evaluate changes in the probability of occurrence of a given set of events consequent on the actual occurrence of one of them.

The value of each scenario method lies in its ability to stretch participants' thinking, introduce new possibilities, challenge long-held assumptions, update mental models, form valuable vehicles for learning and shared understanding, and often become the basis for strategic decision-making.

3. Methodology

Aim of this article is to frame a conjectural framework which makes full allowance for the dynamics and complexity of the various systems involved with the development of 3G mobile services and to generating quantitative results.

Building on the main principles of system thinking [2] and multiple features, we define in this study a scenario as a generally intelligible description of a possible situation in the future, based on a complex network of influence factors [1].

We applied the strategic thinking approach to identify the prerequisites of future success (success potentials) as a basis for development and implementation of visionary strategies. We selected this approach for the following benefits provided by strategic thinking:

1. It reflects a system or holistic view that appreciates how the different parts of the organization influence and impinge on each other as well as their different environments.
2. It embodies a focus on intent. In contrast with the traditional strategic planning approach that focuses on creating “fit” between existing resources and emerging opportunities.
3. It involves thinking in time.

4. Hypothesis generating and testing is central.
5. It invokes the capacity to be intelligently opportunistic, to recognize and take advantage of newly emerging opportunities.

After identifying the key variables, we developed a scenario evaluation applying the cross-impact analysis as this method has been largely used in the literature for specific quantitative studies [39–45].

Strategic thinking and scenario planning are distinct but interrelated and complementary thought processes [46].

The step-by step scientific methodology proposed here is largely inspired also by the work of Yin [47],] and Eisenhardt [48]. Following the recommendations of Yin [47] it involves four distinct stages: (1) design of the case study (detection of key uncertain factors), (2) conduct of the case study (foresight of alternative future projections), (3) analysis of the case study evidence (calculation and formulation of scenarios), and (4) discussion.

3.1. The scenario method

During the past years cross-impact analysis has been largely used for specific quantitative studies [39–45]. We adopt in this paper the approach of Scenario Evaluation and Analysis through Repeated Cross impact Handling (SEARCH). This method has been used in the literature [45] to estimate the impact of different policies on the evolution of a given scenario and to evaluate any risk associated with competitive strategies in different future conditions.

The central idea of this methodology [45] is the assumption that a single event requiring forecasting can be impacted upon by other events. The experience of experts is gathered in the form of subjective probabilities, to determine the likelihood of the events and the impacts between pairs of events. Simulation and mathematical programming techniques are then used to find the scenario with the highest possible probability consistent with the estimates.

Applying the SEARCH method we run our scenario project through the following four phases described by the following consecutive steps:

Phase 1 — Detection of key factors
- a. Determination of the variables characterizing the system
- b. Division of variables into constant, predictable and uncertain factors
- c. Forecasting predictable factors along the temporal horizon
- d. Division of uncertain factors into independent and dependent
- e. Determination of simple events for each independent uncertain factor
- f. Decomposition into subscenarios

Phase 2 — Foresight of alternative projections
- a. Experts' assessment of the marginal probabilities of events
- b. Assignment of compatibility levels between pairs of events belonging to the same scenario

Phase 3 — Calculation and formulation of scenarios
- a. Evaluation of subscenario probabilities
- b. Choice of the most significant alternative subscenarios
- c. Assignment of compatibility levels between pairs of subscenarios
- d. Evaluation of scenario probabilities
- e. Clustering of similar scenarios

Phase 4 — Analysis, mapping and interpretation of scenarios.
- a. Evaluation of dependent factors
- b. Construction of complete scenarios using probabilistic scenarios, dependent factors, forecasts of predictable factors and constant factors
- c. Strategic analysis of complete scenarios

4. Scenario analysis

4.1. Phase 1 — detection of key uncertain factors

We decided to refer to a rather short temporal horizon, from 2008 to 2011, as 3G wireless is undergoing significant transformation both in its network structure (UMTS, DVB-H) and marketing strategies.

Our process of building scenarios for 3G mobile television was collaborative and based on strategic thinking. Initially, participants in semi-structured interviews identified the key areas of uncertainty, trends, challenges and possible contexts that might occur in the 3G wireless industry over the course of the next ten years.

Through 15 communications-industry workshops attended by 190 participants in Europe, we developed these ideas into a set of hypotheses and related feedback loops. Applying Inductive Systems Diagrams we integrated them into a causal loop map [49] and identified the driving forces affecting user adoption of 3G services related to customer dynamics, competitive dynamics, and technology dynamics.

To analyze adoption of 3G mobile TV services we considered the following dynamics: (1) network investment and user population, (2) entry of service innovators as well as price competitors, (3) the effects of positive network externalities arising from

a larger user population, (4) price compression as lower willingness-to-pay users adopt 3G services, (5) scale economies in terminal costs and prices, and (6) new content development as a draw to new users.

We discussed these dynamics more widely during two workshops attended by 60 selected delegates from across the sector in USA and Europe and an academic conference attended by 20 academics.

A total of 60 industry participants took part in the preliminary phase aimed to identify key variable in the wireless industry together with a team of 5 academics and researchers. Sampling was purposive [50], the main industry group consisting of senior executives and other experts from the terrestrial, satellite, cable, Internet and telecommunications networks, programme production companies and interactive gaming, plus market analysts, a government adviser, and representatives of the public relations, advertising and marketing sectors. We selected participants on the basis of a variety of backgrounds, ages and perspectives, including academics and senior and junior members from right across the industrial sector [51].

We used both inductive and deductive methods to identify the key factors influencing wireless value network dynamics. We conducted also eleven face to face interviews with managers in the main industries along the wireless value chain in order to depict key factors influencing the evolution of 3G mobile TV. We listed all the factors indicated by the multidisciplinary experts, without exception.

After finding out the most significant elements for the construction of scenarios about mobile TV, we distinguish three classes of factors: constant (if it has a very little probability of change), predictable (if it can change following largely predictable modalities) and uncertain factors. Table 1 shows the classification of variables.

Fig. 1 highlights emerging uncertain factors in the causal loop map.

After asking three experts to evaluate the causal connection between two events, regardless of the strength or direction of the interaction, the list of uncertain factors was subdivided into four common themes: technology, business model, demand, and competition. Each theme is in turn described by three or five elementary events (Table 2).

4.2. Phase 2 — foresight of alternative future projections

Purpose of the second phase was the construction of the probabilistic segment of scenarios. We conducted 40 interviews (through structured questionnaire) with managers responsible for the launch and development of 3G mobile TV. The sample was composed by managers of companies in Europe and US, along the wireless value chain involved with the development of 3G mobile TV such as content providers (2.5%), content aggregators (20%), application providers (15%), solution providers (10%), network providers (35%), and terminal producers (17.5%).

Respondents were asked to assess the marginal probabilities of single events and to assign a compatibility levels between pairs of events belonging to the same scenario. We report the numerical variables of the marginal probabilities of simple events and the compatibility matrices for the events belonging to the four subscenarios, according to estimates obtained by means of structured questionnaires (Tables 3–10).

4.3. Phase 3 — calculation and formulation of scenarios

Using these data, the application of cross-impact techniques leads to the evaluation of subscenario probabilities. As regards computational aspects, we applied the Scenario Evaluation and Analysis through Repeated Cross impact Handling (SEARCH) method based on the algorithm described by Brauers and Weber [52]. The adoption of compiled Fortran allowed a satisfactory speed of elaboration, given the dimension of the problem.

Table 1
Constant, predictable and uncertain factors

Constant factors	Predictable factors	Uncertain factors	
		Events	Trends
Switch-off analog television: 2012	User population	1. DVB-H network capacity	Number of terminals
Regulation related to Mux for each network operator	Terminal costs	2. Integration of platforms unicast (UMTS) with broadcast (DVB-H)	Market share
Free access to T-DMB services	Terminal prices	3. IP Datacast platform adoption	Viewing time
Emerging alternative standards (i.e. MBMS)	New entrant and incumbent innovation in services and applications	4. Type of content provided	Revenues from pay services for network providers
		5. Advertising revenues for network providers	
		6. Diffusion of value added services (i.e. Datacast)	
		7. Network and revenue sharing	
		8. Total perceived benefits by users	
		9. Willingness to pay the services by users	
		10. Types of use	
		11. Price competition among network providers	
		12. Frequencies reorganization	
		13. Entrance of new mobile TV players	

We selected this method of analysis as it seems more appropriate than elaborate Delphi-like methodologies which are quite suitable for compiling a consensus of expert opinion on the probability of occurrence of specified events to give a convergent view of the future but they do not make allowance for interactions between different events [53].

Using these data, the application of cross-impact techniques leads to the evaluation of subscenario probabilities.

4.3.1. Subscenario 1 — technology

The strategic tendency of network providers is to foresee the transmission of a high number of HDTV channels, to integrate DVB-H and UMTS platforms and to adopt the IP Datacast platform. Value added contents and interactive functions are considered key drivers by network carriers to conquer the customers.

All the players (except for content providers) foresee this scenario S1.1 as the most probable (Table 11). Content providers are more skeptical about the possibility to broadcast many TV channels (Fig. 2).

4.3.2. Subscenario 2 — business models

With reference to the expected business model, players envisage a future in which it is foreseen the high diffusion of ad-hoc contents specifically tailored for mobile TV and value added services.

Players envisage two different and complementary business models: (a) the launch of a free differentiated offer of TV contents funded by advertising and (b) pay per view contents on demand. High revenues and network sharing are foreseen along with uncertain opportunities to collect advertising revenues.

The most probable scenario is mainly characterized by ad-hoc contents specifically tailored for mobile TV and new value added services that allow the user to enrich the experience and offer players new advertising revenues. The high probability of network and revenue sharing indicates a business model based on partnership between mobile network providers and TV broadcasters (Fig. 3).

4.3.3. Subscenario 3 — demand

Players are more skeptical with reference to the demand and its acceptance of mobile TV. The user is expected to have a low level of interest towards mobile TV. Perceived benefits and willingness to pay for new contents are envisaged as the most critical areas. Fruition of mobile TV contents is mainly outdoor and in this context the device is mainly used for fun rather than for an

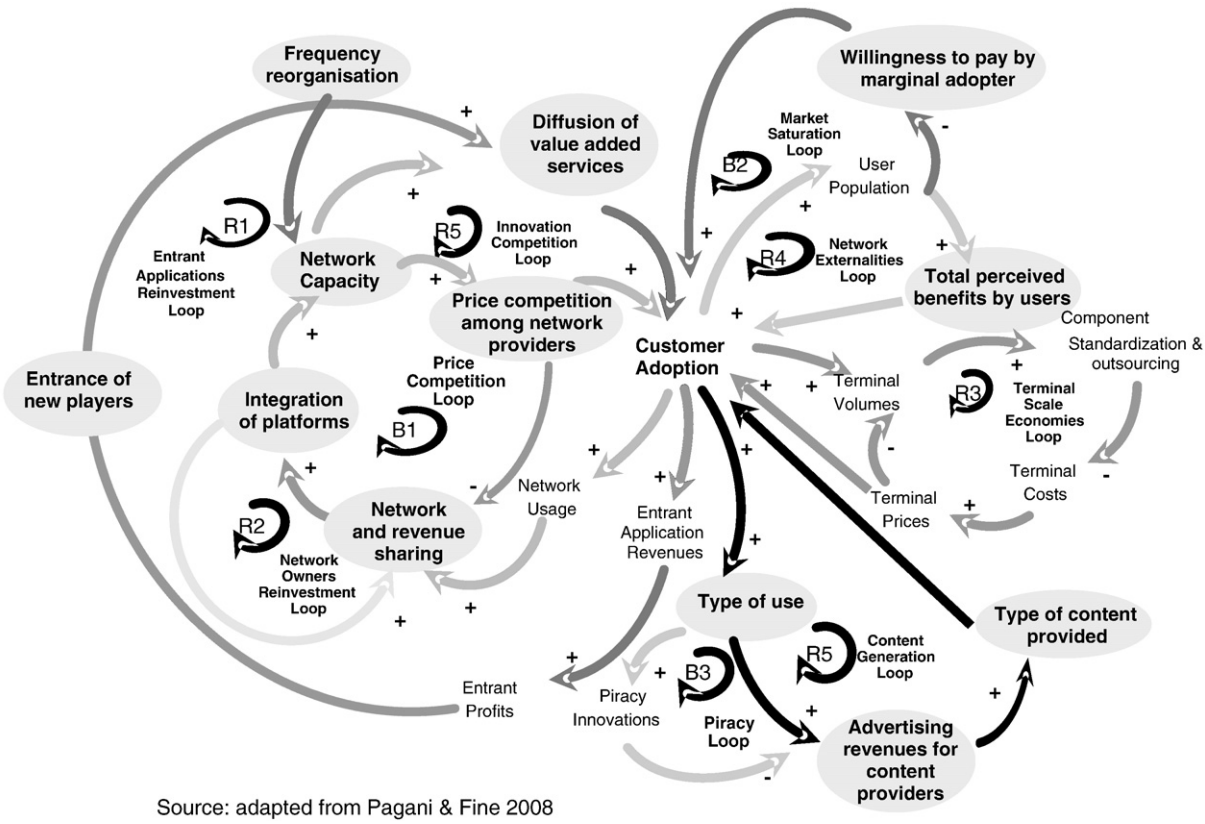

Fig. 1. Key uncertain factors. Source: Adapted from Pagani and Fine (2008).

Table 2
Areas of analysis

Subscenario 1. technology	Subscenario 3. demand
1. Number of DVB-H channels	8. Total perceived benefits by users
2. Integration between unicast (UMTS) and broadcast (DVB-H) platforms	9. Willingness to pay the services by users
3. IP Datacast platform adoption	10. Types of use
Subscenario 2. business model	**Subscenario 4. competition**
4. Diffusion of ad-hoc contents for mobile TV	11. Price competition among network providers
5. Advertising revenues for network providers	12. Frequency reorganization
6. Diffusion of value added services (i.e. Datacast)	13. Entrance of new players in the mobile TV offer
7. Network and revenue sharing	

Table 3
Subscenario 1: technology

Uncertain factors	Events	Marginal probabilities
1.A Number of DVB-H channels	1.A1 High	0.55
	1.A2 Low	0.45
1.B Integration between unicast and broadcast platforms	1.B1 Yes	0.65
	1.B2 No	0.35
1.C IP Datacast platform adoption	1.C1 Yes	0.68
	1.C2 No	0.32

Table 4
Subscenario 1: compatibility matrix

Influence matrix	Events	$P(i)$	A1	A2	B1	B2	C1	C2
Question: how strong is the impact factor A (row) on factor B (column)								
1.A Number of DVB-H channels	A1 High	0.55	x					
	A2 Low	0.45	1	x				
1.B Integration between unicast and broadcast platforms	B1 Yes	0.65	3	3	x			
	B2 No	0.35	2	3	1	x		
1.C IP Datacast platform adoption	C1 Yes	0.68	3	3	3	3	x	
	C2 No	0.32	2	3	2	3	1	x

Table 5
Subscenario 2: business models

Uncertain factors	Events	Marginal probabilities
2.A Diffusion of ad-hoc contents for mobile TV	A1 High	0.59
	A2 Low	0.41
2.B Advertising revenues for service providers	B1 High	0.47
	B2 Low	0.53
2.C Diffusion of value added services	C1 High	0.58
	C2 Low	0.42
2.D Network and revenue sharing	D1 High	0.56
	D2 Low	0.44

Table 6
Subscenario2: compatibility matrix

Influence matrix	Events	$P(i)$	A1	A2	B1	B2	C1	C2	D1	D2
Question: how strong is the impact factor A (row) on factor B (column)										
2.A Diffusion of ad-hoc contents for mobile TV	A1. High	0.59	x							
	A2. Low	0.41	1	x						
2.B Advertising revenues for service providers	B1. High	0.47	3	2	x					
	B2. Low	0.53	2	4	1	x				
2.C Diffusion of value added services	C1. High	0.58	4	3	3	3	x			
	C2. Low	0.42	2	3	2	3	1	x		
2.D Network and revenue sharing	D1. High	0.56	3	3	3	3	3	2	x	
	D2. Low	0.44	3	3	2	3	2	3	1	x

Table 7
Subscenario 3: demand

Uncertain factors	Events	Marginal probabilities
3.A Perceived benefits by consumers	A1 High	0.51
	A2 Low	0.49
3.B Willingness to pay	B1 High	0.46
	B2 Low	0.54
3.C Main way of use	C1 Indoor	0.42
	C2 Outdoor	0.58

Table 8
Subscenario 3: compatibility matrix

Influence matrix	Events	$P(i)$	A1	A2	B1	B2	C1	C2
Question: how strong is the impact factor A (row) on factor B (column)								
3.A Perceive benefits by consumers	A1 High	0.51	x					
	A2 Low	0.49	1	x				
3.B Willingness to pay	B1 High	0.46	3	1	x			
	B2 Low	0.54	3	4	1	x		
3.C Main way of use	C1 Indoor	0.42	3	2	2	3	x	
	C2 Outdoor	0.58	3	3	3	3	1	x

Table 9
Subscenario 4: competition

Uncertain factors	Events	Marginal probabilities
4.A. Price competition among network providers	A1 Strong	0.60
	A2 Limited	0.40
4.B Frequency reorganization	B1 Yes	0.51
	B2 No	0.49
4.C Entrance of new players in the mobile TV offer	C1 Yes	0.53
	C2 No	0.47

interactive and personalized fruition. Mobile TV is not perceived as a substitute of traditional television rather than a complement that allow to satisfy specific needs and requirements in mobility.

Content providers are the more skeptical about the user acceptance and they attribute to this scenario a high probability (46%) (Fig. 4).

4.3.4. Subscenario 4 — competition

It is expected a strong price competition among network providers and content providers. This phenomenon could imply the tendency to compete more on price rather than on quality and differentiation given the low revenues and lower investments. The reorganization and allocation of frequencies is considered the most important driver to the development of mobile TV. New entrants in the market are expected to offer new services and increase the richness.

This scenario is considered the most probable both by network providers and terminal producers which are particularly convinced about the strong price competition and the entrance of new players. Content providers and ASP are the most skeptical about the entrance of new players (Fig. 5).

5. Plausible scenarios

In order to evaluate the plausible scenarios we decided to select the three most probable subscenarios in each group and renormalize their probabilities. In subscenario 1 (technology) we selected S1.1; S1.3; and S1.5 (Table 11); in subscenario 2 (business

Table 10
Subscenario 4: compatibility matrix

Influence matrix	Events	$P(i)$	A1	A2	B1	B2	C1	C2
Question: how strong is the impact factor A (row) on factor B (column)								
4.A. Price competition among network providers	A1 Strong	0.60	X					
	A2 Limited	0.40	1	x				
4.B Frequency reorganization	B1 Yes	0.51	3	2	x			
	B2 No	0.49	3	3	1	x		
4.C Entrance of new players in the mobileTV offer	C1 Yes	0.53	3	3	3	3	x	
	C2 No	0.47	2	2	2	3	1	x

Table 11
Subscenario 1: technology [a]

Subscenarios	Description	Marginal probabilities					
		Content provider	Content agg.	ASP	Network provider	Terminal providers	Total
S1.1 (1.A, 2.A, 3.A)	High number of TV channels, unicast/broadcast integration adoption of IP Datacast	0.175	**0.2929**	0.196	**0.2544**	**0.3409**	**0.2375**
S1.5 (1.B, 2.A, 3.A)	Low number of TV channels unicast/broadcast integration adoption of IP Datacast	**0.28**	0.156	0.147	0.2256	0.1699	0.2045
S1.3 (1.A, 2.B, 3.A)	High number of TV channels no unicast/broadcast integration adoption of IP Datacast	0.03	0.1369	**0.204**	0.0901	0.0573	0.1365
S1.2 (1.B, 2.A, 3.B)	Low number of TV channels, unicast/broadcast integration no adoption of IP Datacast	0.065	0.0957	0.0735	0.0954	0.0982	0.1200
S1.7 (1.B, 2.B, 3.A)	Low number of TV channels no unicast/broadcast integration adoption of IP Datacast	0.27	0.0841	0.153	0.0799	0.0667	0.1015
S1.6 (1.B, 2.A, 3.B)	Low number of TV channels, unicast/broadcast integration no adoption of IP Datacast	0.08	0.1254	0.0735	0.0846	0.139	0.088
S1.4 (1.A, 2.B, 3.B)	High number of TV channels, no unicast/broadcast integration no adoption of IP Datacast	0.03	0.0545	0.0765	0.0901	0.0573	0.056
S1.8 (1.B, 2.B, 3.B)	Low number of TV channels, no unicast/broadcast integration no adoption of IP Datacast	0.07	0.0545	0.0765	0.0799	0.0708	0.056

[a] In bold the most probable scenario for each phase of the value chain.

models) we selected S2.1; 2.13; and 2.15 (Table 12); in subscenario 3 (demand) we selected S3.8; S3.2; and S3.4 (Table 13) and in subscenario 4 (competition) we selected S4.1; S4.3; and S4.2 (Table 14).

The cross-impact module was run again, this time imputing data obtained for the twelve subscenarios. The compatibility matrix of these subscenarios and the normalized probabilities are presented in Tables 15 and 16.

The results of the elaboration are shown in Table 17.

We consider only the scenario with the highest probability (0.04), that is the scenario composed by subscenarios 1.1, 2.1, 3.8, and 4.1 belonging respectively to the four groups determined at the beginning (Table 17). The simple events identifying this scenario are:

- (technology) High number of DVB-H channels, integration between unicast and broadcast platforms, adoption of platform IP Datacast;
- (business models) High diffusion of ad-hoc contents for mobile TV, high advertising revenues, high diffusion VAS, high network and revenue sharing,

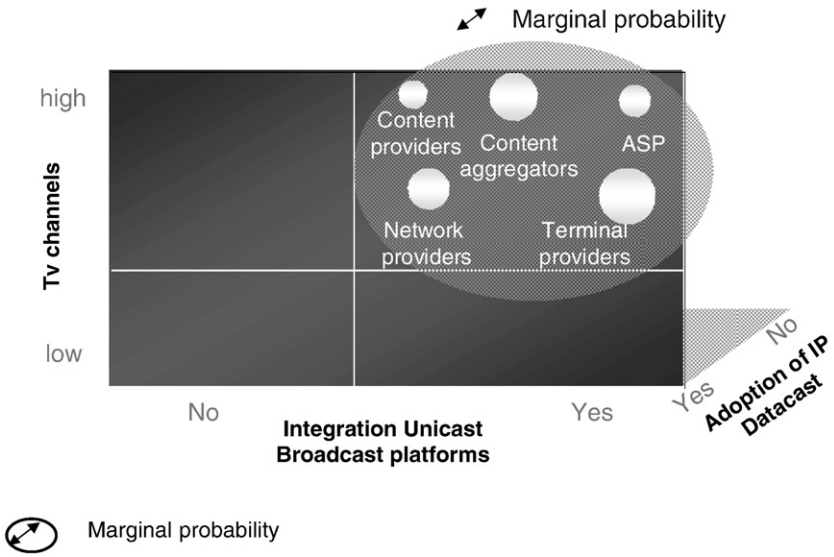

Fig. 2. Subscenario technology.

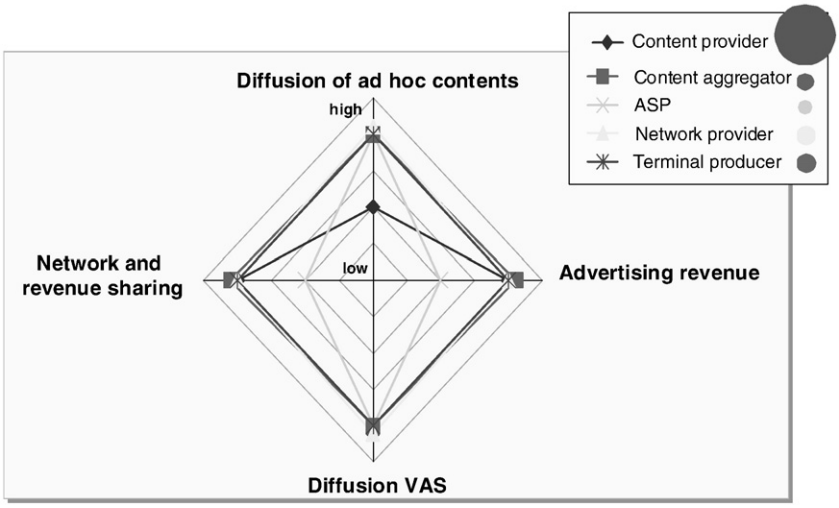

Fig. 3. Subscenario business model.

- (demand) Low perceived benefits, low willingness to pay, outdoor fruition;
- (competition) Strong price competition, frequency reorganization, new players entry.

6. Strategic analysis

An exhaustive strategic analysis of all the complete scenarios obviously goes beyond the scope of this work, but this last step is of fundamental importance for the strategic planner.

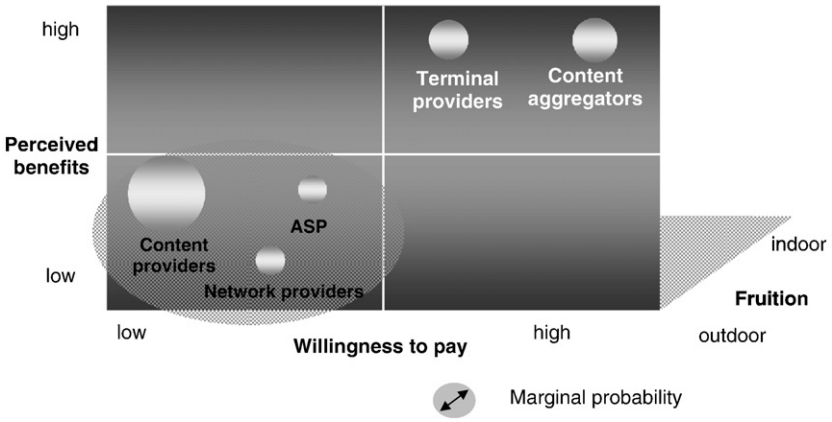

Fig. 4. Subscenario demand.

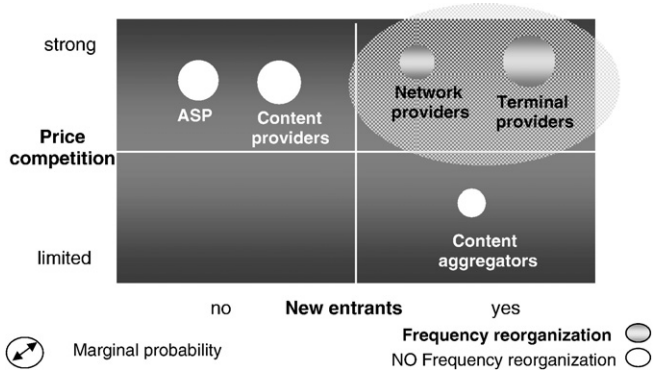

Fig. 5. Subscenario competition.

Table 12
Subscenario 2: business models[a]

Subscenarios	Description	Marginal probabilities					
		Content provider	Content agg.	ASP	Network provider	Terminal producers	Total
S2.1 (4.A, 5.A, 6.A, 7.A)	High diffusion of ad-hoc contents High advertising revenues High diffusion VAS High network and revenue sharing	0.0366	**0.0941**	0.0617	**0.1032**	**0.1086**	**0.0986**
S2.13 (4.B 5.B, 6.A, 7.A)	Low diffusion of ad-hoc contents Low advertising revenues High diffusion VAS High network and revenue sharing	0.039	0.0875	0.063	0.0633	0.0302	0.086
S2.15 (4.B, 5.B, 6.B, 7.A)	Low diffusion of ad-hoc contents Low advertising revenues Low diffusion VAS High network and revenue sharing	0.039	0.0632	0.0593	0.0839	0.0639	0.0834
S2.2 (4.A, 5.A, 6.A, 7.B)	High diffusion of ad-hoc contents High advertising revenues High diffusion VAS Low network and revenue sharing	0.0122	0.0802	0.0643	0.0779	0.0834	0.0775
S2.3 (4.A, 5.A, 6.B, 7.A)	High diffusion of ad-hoc contents High advertising revenues Low diffusion VAS High network and revenue sharing	0.1341	0.068	0.0582	0.0353	0.0706	0.0739
S2.4 (4.A, 5.A, 6.B, 7.B)	High diffusion of ad-hoc contents High advertising revenues Low diffusion VAS Low network and revenue sharing	0.0122	0.068	0.0605	0.0353	0.0646	0.0739
S2.16 (4.B, 5.B, 6.B, 7.B)	Low diffusion of ad-hoc contents Low advertising revenues Low diffusion VAS Low network and revenue sharing	0.0195	0.0632	0.0617	0.0633	0.0544	0.0676
S2.14 (4.B, 5.B, 6.A, 7.B)	Low diffusion of ad-hoc contents Low advertising revenues High diffusion VAS Low network and revenue sharing	0.0854	0.0745	0.0657	0.0364	0.0302	0.0676
S2.5 (4.A, 5.B, 6.A, 7.A)	High diffusion of ad-hoc contents Low advertising revenues High diffusion VAS High network and revenue sharing	0.0244	0.0721	0.0733	0.0633	0.0975	0.0613
S2.6 (4.A, 5.B, 6.A, 7.B)	High diffusion of ad-hoc contents Low advertising revenues High diffusion VAS Low network and revenue sharing	0.0122	0.0667	**0.0767**	0.0564	0.0925	0.0559
S2.7 (4.A, 5.B, 6.B, 7.A)	Low diffusion of ad-hoc contents Low advertising revenues Low diffusion VAS High network and revenue sharing	0.0244	0.0614	0.0686	0.0753	0.0706	0.055
S2.8 (4.A, 5.B, 6.B, 7.B)	High diffusion of ad-hoc contents Low advertising revenues Low diffusion VAS Low network and revenue sharing	0.0122	0.0614	0.0717	0.0633	0.0646	0.055
S2.9 (4.B, 5.A, 6.A, 7.A)	Low diffusion of ad-hoc contents High advertising revenues High diffusion VAS High network and revenue sharing	0.3293	0.035	0.0542	0.0811	0.0302	0.0361
S2.10 (4.B, 5.A, 6.A, 7.B)	Low diffusion of ad-hoc contents High advertising revenues High diffusion VAS Low network and revenue sharing	0.0463	0.0349	0.0561	0.0716	0.0302	0.0361
S2.11 (4.B, 5.A, 6.B, 7.A)	Low diffusion of ad-hoc contents High advertising revenues Low diffusion VAS High network and revenue sharing	**0.1537**	0.0349	0.0517	0.0353	0.0544	0.0361
S2.12 (4.B, 5.A, 6.B, 7.B)	Low diffusion of ad-hoc contents High advertising revenues Low diffusion VAS Low network and revenue sharing	0.0195	0.0349	0.0533	0.0353	0.0544	0.0361

[a] In bold the most probable scenario for each phase of the value chain.

Table 13
Subscenario 3: demand [a]

Subscenarios	Description	Marginal probabilities					
		Content provider	Content aggr.	ASP	Network provider	Terminal producers	Total
S3.8 (8.B, 9.B, 10.B)	Low perceived benefits Low willingness to pay Outdoor	**0.46**	0.2472	**0.1732**	**0.1749**	0.2244	**0.1715**
S3.2 (8.A, 9.A, 10.B)	High perceived benefits High willingness to pay Outdoor	0.035	**0.2664**	0.1613	0.1254	**0.2362**	0.1541
S3.4 (8.A, 9.B, 10.B)	High perceived benefits Low willingness to pay Outdoor	0.255	0.06	0.1687	0.1331	0.0765	0.1417
S3.3 (8.A, 9.B, 10.A)	High perceived benefits Low willingness to pay Indoor	0.1	0.06	0.134	0.1125	0.1093	0.1176
S3.6 (8.B, 9.A, 10.B)	Low perceived benefits High willingness to pay Outdoor	0.05	0.0664	0.0967	0.1166	0.0529	0.1127
S3.7 (8.B, 9.B, 10.A)	Low perceived benefits Low willingness to pay Indoor	0.08	0.1128	0.094	0.1395	0.1398	0.1092
S3.1 (8.A, 9.A, 10.A)	High perceived benefits High willingness to pay Indoor	0.01	0.1136	0.086	0.099	0.108	0.0966
S3.5 (8.B, 9.A, 10.A)	Low perceived benefits High willingness to pay Indoor	0.01	0.0736	0.086	0.099	0.0529	0.0966

[a] In bold the most probable scenario for each phase of the value chain.

It emerges that the demand is the most critical and uncertain variable. Perceived benefits and willingness to pay for mobile TV services are the most critical aspects that need to be explored and understood by the players. Players need to understand which are the most important drivers influencing the adoption, how to increase perceived value and the related willingness to pay for emerging 3G services. The right content mix will drive high subscriber growth, which in turn will support strong advertising revenues. Mobile TV offers the opportunity to have a 1:1 advertising relationship with consumers, and this capability is valuable to the advertising brands. Value added services represent a major opportunity to increase profit.

Table 14
Subscenario 4: competition [a]

Subscenarios	Description	Marginal probabilities					
		Content provider	Content agg.	ASP	Network provider	Terminal producers	Total
S4.1 (11.A, 12.A, 13.A)	Strong price competition Frequency reorganization New entrants	0.025	0.0819	0.1969	**0.2422**	**0.3556**	**0.1603**
S4.3 (11.B, 12.B, 13.A)	Strong price competition No frequency reorganization New entrants	0.0225	0.0799	0.0831	0.2086	0.094	0.1577
S4.2 (11.A, 12.A, 13.B)	Strong price competition Frequency reorganization No new entrants	0.215	0.1482	0.0994	0.0811	0.049	0.1457
S4.4 (11.A, 12.B, 13.B)	Strong price competition No frequency reorganization No new entrants	**0.0375**	0.0799	**0.2805**	0.0781	0.1164	0.1363
S4.5 (11.B, 12.A, 13.A)	Limited price competition Frequency reorganization New entrants	0.2175	0.1659	0.0468	0.0546	0.1064	0.11
S4.6 (11.B, 12.A, 13.B)	Limited price competition No frequency reorganization New entrants	0.1425	**0.194**	0.0468	0.1521	0.049	0.102
S4.7 (11.B, 12.B, 13.A)	Limited price competition Frequency reorganization No new entrants	0.0375	0.0923	0.0732	0.0546	0.094	0.094
S4.8 (11.B, 12.B, 13.B)	Limited price competition No frequency reorganization No new entrants	0.3025	0.1579	0.0732	0.1287	0.1356	0.094

[a] In bold the most probable scenario for each phase of the value chain.

Table 15
Global scenario: evolution mobile TV [a]

Events	Description	Marginal probabilities (renorm.)
Technology		
S1.1	Many channels, unicast/broadcast, IP Datacast	**0.41**
S1.5	Few channels, unicast/broadcast, IP Datacast	0.35
S1.3	Many channels, no unicast/broadcast, IP Datacast	0.24
Business models		
S2.1	Many ad-hoc contents, high advertising revenues, high diffusion of VAS, high network and revenue sharing	**0.37**
S2.13	Few ad-hoc contents, low advertising revenues, high diffusion of VAS, high network and revenue sharing	0.32
S2.15	Few ad-hoc contents, low advertising revenues, low diffusion of VAS, high network and revenue sharing	0.31
Demand		
S3.8	Low benefits, low willingness to pay, outdoor fruition	**0.37**
S3.2	High benefits, high willingness to pay, outdoor fruition	0.33
S3.4	High benefits, low willingness to pay, outdoor fruition	0.30
Competition		
S4.1	Strong competition, frequency reorganization, new players	**0.35**
S4.3	Strong competition, no frequency reorganization, new players	0.34
S4.2	Strong competition, frequency reorganization, no new players	0.31

[a] In bold the most probable scenario for each group.

Table 16
Global scenario: compatibility matrix

Subscenarios	$P(i)$		Cross-impact											
			S11	S15	S13	S21	S213	S215	S38	S32	S34	S41	S43	S42
S1. technology	0.41	S1.1	x											
	0.35	S1.5	1	x										
	0.24	S1.3	1	1	x									
S2. business models	0.37	S2.1	3	2	3	x								
	0.32	S2.13	2	3	4	1	x							
	0.31	S2.15	2	4	2	1	1	x						
S3. demand	0.37	S3.8	3	2	2	4	3	2	x					
	0.33	S3.2	3	3	3	3	4	2	1	x				
	0.30	S3.4	2	4	3	2	3	4	1	1	x			
S4. competition	0.35	S4.1	3	2	3	4	3	2	5	4	1	x		
	0.34	S4.3	3	2	2	2	3	2	3	3	2	1	x	
	0.31	S4.2	2	3	4	3	3	3	3	3	4	1	1	x

Content providers appear as the most skeptical players about the development of 3G value added services.

The evolution of mobile TV underlines a very important strategic factor: the synergy of interests rather than the competition between network carriers, content and service providers. The network providers put their primary interest into the development of traffic to increase their profits but the right mix of content is critical to the success of a mobile TV service. The content mix must allow the service provider to offer a large proportion of the long tail of content to meet mass-market demand.

Particular attention must also be directed towards competitors: a guarantee of success is a sensible forecast of their behaviour in the theoretical context of different scenarios.

The mobile TV offering must clearly differentiate itself from its competition, preferably through a non-replicable unique selling point. This differentiation can be through interactivity, exclusive content rights, tight integration of offers and service sophistication.

Table 17
Global scenario: roadmap of mobile TV [a]

Scenarios	Description	Scenario probabilities
1	**S1.1+S2.1+S3.8+S4.1**	**0.040**
53	S1.5+S2.15+S3.4+S4.3	0.025
55	S1.3+S2.1+S3.8+S4.1	0.025
67	S1.3+S2.13+S3.2+S4.1	0.024
4	S1.1+S2.1+S3.2+S4.1	0.024
58	S1.3+S2.13+S3.2+S4.1	0.024
13	S1.1+S2.13+S3.2+S4.1	0.023
72	S1.3+S2.13+S3.4+S4.2	0.023
26	S1.1+S2.15+S3.4+S4.3	0.027
57	S1.3+S2.1+S3.8+S4.2	0.020

[a] In bold the most probable global scenario.

7. Conclusions

In conclusion the strategic importance of the mobile TV lies in its potential capacity to stimulate the mass market. This implies the importance to understand the specific needs of users and to allow them to understand the benefits offered by these new services.

The method adopted in this study SEARCH emphasizes the link between forecasting and planning, promoting an overall prospective vision. Its implementation singles out the cause–effect relationships in order to understand the dynamics of the sector, the variables to be kept under observation and the range of alternatives around which it is necessary to build a strategy.

We use this method to develop multiple plausible future scenarios for the industry, with the expectation that further data collection and ongoing experience with this technology generation will shed increasing amounts of light onto the relative likelihood of each scenario.

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