

ROMANIA'S REVOLUTION IN TELECOMMUNICATIONS AND INFORMATION TECHNOLOGY: A GEOGRAPHICAL APPROACH

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Abstract: Economic restructuring since 1989 has created an environment in which this economic branch has been able to expand through private enterprise; involving both the former state monopoly (through the creation and subsequent privatisation of Romtelecom – emerging from the communist PTTR organisation) and a fiscal regime conducive to private investment both domestic and foreign; not to mention appropriate regimes of licensing and regulation as well as stimulatory measures to accelerate the absorption of information technology. While development has been very rapid globally, Romania's progress is particularly striking given the low priority for state investment in the 1980s coupled with the enthusiasm of consumers over the past decade and the commitments made by foreign investors. The paper provides a historical introduction before examining recent developments in telephony (both fixed and mobile), cable television and information technology; emphasising the diversity of methods for Internet access; based on material culled from the economic press throughout the post-1989 period. Attention is given to both domestic and foreign IT companies; noting location policies which emphasise not only Bucharest but also the country's 'metropolises' which are very attractive on account of their accessibility and labour markets.

Key Words: *Cable Television; Computer Hardware/Software; Fixed Telephony; Foreign Investment; Information Technology; Internet; Mobile Telephony*

Introduction

No economic branch has been transformed more radically since 1989 than telecommunications (TC) and information technology (IT). This is a highly dynamic and successful sector that projects Romania in a particularly favourable light with regard to growth, innovation and enterprise. Embracing fixed/mobile telephony, computerisation and the Internet, the market was valued at some €3.6bln in 2003 and €4.5bln in 2004. Progress has been encouraged by government but reference should also be made to the pool of skilled labour in engineering and electronics amounting to over 50,000 IT specialists and a significant number of software developers. The conclusion of the Romtelecom (RT) privatisation process was anticipated in 2001 as a major stage in achieving an

open and competitive market. Following the independent regulatory strategy of 2000, deregulation in 2003 – in line with commitments assumed through the World Trade Organisation – brought an immediate surge in business marked by a sharp fall in the cost of international phone calls. Since then, the National Authority for Communications Regulation (Ancom) has authorised over 2,550 companies to supply electronic communications and services, including some 590 for data transmission services, 700 for Internet access and 225 for professional mobile telephony services (divided equally between local/long distance calls on the one hand and international calls and mail services on the other). The paper offers a brief historical review before examining the progress made since 1989 with

particular attention to fixed and mobile telephony, cable television and information technology. There is little previous work to draw on since the topic is very much a 'Cinderella' subject in geography: it usually receives scant attention in textbooks on Romanian economic geography and even those dedicated to transport matters. The paper has therefore been based heavily on the economic press which has been monitored throughout the post-1989 period to provide a balanced picture illustrated with a range of examples.

A Historical Note

For centuries it was the postal system that provided the basis of the communication system and in the Romanian lands there were notable improvements to the service under Alexandru Ipsilanti in 1775 (establishing a state post, made available for private use in 1790) and Prince Cuza in 1865-6 (with the first post/telegraph law and the organisation of a rural post). By this time the post involved a 'stația' network whereby each 'căruță de poștă' could change horses; while some 2,900kms of telegraph lines (with some 50 stations) were available by 1870, thanks to the energy of Cezar Librecht who managed the business from 1864 (following the union of Moldavia and Wallachia in 1859). Telegraphy originated in the Principalities at the time of the Crimean War (1853) when the Austrians were allowed to extend their Sibiu-Brașov link to Bucharest (also from Bucharest to Craiova and from Ploiești to Brăila and Galați) while French signallers under Capt. Lamy worked from Bucharest to Giurgiu and Ruse. In the same year the Austrian system linking Vienna with Bucovina was extended through Moldavia to Iași (Boicu 1955; Perciun 1990). Further expansion was very strongly

influenced by the railway which was also developing at this time (Cebuc & Mocanu 1967; Marinescu 1995) and clearly had a bearing on Romania's independence in 1877 through the importance of communications for the military campaign in northern Bulgaria. Meanwhile the telephone arrived in the present Romanian territory at Timișoara in 1881-2; while Bucharest, which acquired a telephone exchange for government use in 1889 (made available to the public the following year), became part of an inter-urban system linked with Brăila and Galați in 1890 (with public use following in 1893): part of a process of transferring technology to the European periphery (Jensen & Rosegger 1978). Meanwhile in 1890 railway engineers A.Cottescu and M.H.Romniceanu installed a central control system ('aparatură cu telecomandă centralizată') at Buftea (Bălan & Mihăilescu 1985, p.210). Bucharest to Ploiești and Sinaia was another early inter-urban telephone link before the rail-based system was extended nationally and internationally to reach Budapest via both Brașov-Cluj-Oradea and Craiova-Orșova-Szeged, as well as Vienna via Burdujeni (Suceava). The service was a state monopoly, grandly projected by a palatial headquarters building in Bucharest in 1899.

Unified systems for administration and defence (as well as public use) were the immediate goal after the First World War when military applications were crucial to the military successes in Vrancea. The achievement of national unity created a greatly enlarged system which in 1926 comprised some 18,400kms of telegraph/telephone lines, including the submarine Constanța-Pera (Istanbul) cable of 1905 (when the Berlin-Bucharest-Constanța line was also finished) and the

subfluvial Piuă Petrii-Hârșova line of 1925 (Enciu 1984, p.299). The Liberal philosophy of self-sufficiency was modified by acceptance of foreign capital by 1930 in the shape of the concession awarded to the American-owned ITT Company (preferred to Ericsson and Siemens & Halske) which operated in Romania as 'Societatea Anonimă Română de Telefoane' (SART). Automatic exchanges that had made an appearance from 1927 were now extended to 13 major provincial cities (and Sinaia) during the 1930s with Bucharest's 'Palatul Telefoanelor' of 1933 symbolising the completion of telephone automation in the capital. An interurban system connecting the "județ" centres provided for a rapid increase in such calls from 3.0 to 11.8mln during 1931-43. There were also international telephone links with the allied capitals of Belgrade (via Pitești, Orșova and Baziaș); Prague (via Cluj, Bistrița, Vișeu and Sighetul Marmăției) and Warsaw (following the same route to Vișeu and thence to Stryj and Lwów via Muntele Copilași). Underground cabling was another innovation which was completed between Bucharest and the Polish frontier north of Cernăuți as well as the loop connecting Bucharest, Brașov, Câmpulung and Târgoviște; also the Anina-Reșița area, the Bucegi chalets and a number of spas including Slănic (Moldova). Defence considerations were very much tied up with the Carpathian routes and where resources were insufficient for the completion of new railway projects new TC links were achieved e.g. Brașov-Buzău and Orșova-Moldova Nouă. The Hungarian frontier was a particular concern reflected by the 1927-8 fortification plan implemented from 1937 including new railway communication with Oradea from Hunedoara which was also meant to serve an economic function in

terms of energy and manufactures (Turnock 2004). The military importance of TC was amply demonstrated once more by the successful advances into Bessarabia, Bucovina and Transnistria in 1941-2 and the support of the Soviet advance in Hungary and Slovakia in 1944-5.

Under communism automatic exchanges were slowly extended in the urban sphere although it was the Third Five Year Plan (1961-5) that launched the interurban system using underground cables and radio-relay (Enciu 1984, p.417): by the 1970s special 'inter-urban' call boxes were provided at post offices in the main cities with direct dialling to cities in the network. Rural systems using manual exchanges that were first provided on a significant scale after 1918 were now extended. And by 1965 there was a ministry dedicated to post and TC with a network of PTTR regional offices (and a county structure from 1968). Growth of manufacturing capacities was a priority and reference should be made to the 'Stația de sol' at Cheia in Mâneciu commune (Prahova) in 1976 for international TC linked with Intelsat: the antenna 12m in diameter was made domestically by IPMPB (Pitești) under Japanese licence. And another notable achievement was the system of TV/radio/radio-relay stations that followed the launch of TV in 1956: three Carpathian stations (completed by 1975) were particularly challenging: Coștila (at 2,490m in the Bucegi Mountains) in 1966-8 (after the first station in 1960) and three others: Harghita (at 1,600m in the range of that name), Râncea (at 1,600m in the Parâng) and Gozna (at 1,450m in the Semenic Mountains) (Iordănescu & Georgescu 1986, II pp.151-68). However the capacity for fixed telephones always fell far short of demand, with international calls both complicated and expensive.

TC was certainly a branch that helped portray the central planning system as an economy of shortages for it lay outside the privileged industrial sector that attracted consistently high priority. Although RT's copper network continued to grow, capacity was restricted in rural areas where the service was geared primarily towards the local authorities and many outlying villages were totally isolated.

FIXED TELECOMMUNICATIONS

Romtelecom (RT) was formed in 1991 through the splitting of the old PTTR company (the state post/telegraph/telephone provider) but improvements were initially slow and non-local calls in rural areas typically required queuing at manual exchanges; while development was impeded across the region as a whole by political pressure to hold down prices (discouraging investment) and the 'strategic' nature of phone lines made for prejudice against foreign companies in the privatisation stakes. The outdated, costly and inefficient system was a drag on IT&C as a whole because it was not adapted to transmit large amounts of data. Moreover 85% of RT's old cables were made of lead: they were letting in water and deteriorating so much that replacement became essential. There was a growth in capacity from 180,000 new subscribers in 1996 to 450,000 in 1997, but this was biased strongly to urban areas and rural applicants in Călărași (for example) were still destined to wait up to 20 years for a connection given the then-current rate of progress scored. But rapid change occurred following 35% privatisation of RT in 1998 in favour of Greek Telecom (OTE) which became a significant regional player (with an important stake in Telecom Serbia). OTE succeeded after the competition was reduced to STET (Italy)

when French and German companies pulled out; giving rise to conspiracy theories about secret agreements to get the buying price down! Under the deal, giving OTE the right to acquire 16–35% more of the company in the second round (when its holding actually increased to 54%, while government retained 46%), capacity growth of over 500,000 new phones per annum was expected, along with a national data infrastructure including integrated services (ISDN) and Internet access; with a particularly fast expansion in Bucharest. 98% of the system is now automatic and 71% digitalised through optical fibre cable or radio relay.

The total number of fixed subscribers reached 4.21mln in 2002 and 4.39mln in 2004–5, although many found phone cards expensive and difficult to obtain. Profits reached €107mln (5.0%), but a sharp dip from 2000–1 (attributed to losses of €58.7mln in OTE's mobile branch: Cosmorom) made for uncertainty over the company's desire to buy the state's remaining 35% stake in the second round of privatisation (a crucial element in the Năstase government's ITC policy based on an open and competitive market). But despite rising subscriptions to generate capital after privatisation – and the pressure of impending deregulation (see below) – it was more than an overnight job to modernise and expand, with just 3.2mln subscribers in 1998 (roughly in line with the regional average of a quarter of all households: well above Albania's 5.0% but below the northern states – and Bulgaria – with over 30%). Moreover only 1.2mln subscribers were connected to digital exchanges. While the government wanted \$3.4bln spent over 10 years, OTE planned to invest \$2.7bln in updating RT over five years (from 1999) with digital systems increasing from 40% to 70% by 2002 and quicker

connection for the many applicants waiting in the rural areas. OTE envisaged that over two years, two public phones (working with cards) would be provided in each locality of over 1,000 population with similar provision for villages of 500–1000 people during the third year and one phone for each villages of 100–500 people in the fifth year. Of the 750,000 applications outstanding at privatisation 600,000 were dealt with during 1998. And in a bid to solve the problem of some 3,700 rural localities with no telephone links at all, a crash programme was launched in 1998 to install Intrarom-type public phones with Nokia 10 adapters to harmonise with old cabling. Meanwhile employment was to be reduced from 50,000 to 30,000 by 2002; the actual figures being 43,000 in 1998, 23,800 in 2003 and 18,100 in 2004: 240 phone lines per worker compared with 300–500 in Western Europe.

Digitalisation

Based on optical fibre cable systems (crucial for increased capacity), this development lay at the core of modernisation for fixed telephony and IT. But by the end of 1995 RT had laid only 1,800kms along the main routes between Arad, Timișoara and Constanța with branches to Bacău, Brașov, Cluj-Napoca (henceforth Cluj), Craiova and Galați. There were also local optical fibre rings round leading centres by 1995; as well as seven high capacity digital transit centres and 34 local digital centres by 1996. The consultancy company Dofrecom (France) drew up a post-privatisation development programme for 10,000kms of cable in cooperation with North American partners: AT&T and Sprint (USA) and Telecom (Canada). The aim was also to replace old equipment – taking 20lei (old currency) pieces – over four to five years with

new phones taking prepaid magnetic cards. New Telcor sets were imported from South Africa in the early 1990s, but the intention was to change to equipment provided by the Romanian-Greek company Intrarom in 1996. In fact RT invested €500mln in new Alcatel and Ericsson equipment to upgrade to the Next Generation Network (NGN) for faster web surfing and new data and voice services. Starting in 2001 RT provided telephony services through the Internet intermediary, with investments for high speed transmission incorporating data, voice, video and Internet services. And very significantly the cost of long-distance and international telephone calls was reduced following deregulation. The digitalisation rate crept up to 55% in 2000 (though still below Macedonia's 61%; not to mention the rates of over 70% in Bulgaria, Czech Republic and Hungary and Poland's 97% level). However the Romanian level approached two-thirds in 2002: 80% in Bacău, Covasna, Harghita and Neamț counties compared with a below-average performance in Bucharest and Giurgiu. RT also took over the Artelecom Internet service provider.

International Digital Links. The Black Sea Fibre Optic Submarine Cable System (KAFOS) is a joint venture between the national operators in Bulgaria, Romania and Turkey and Deutsche Telecom first mentioned in 1995–6: a 600km submarine cable connects Istanbul, Varna and Mangalia with Moldova linked through Romania. It cost \$27mln and became operational during 1997; aiming to improve international connections with the rest of the world (a China-Turkey link was discussed back in 1995). Meanwhile a line between Bucharest and Sofia gave Romania links with

Athens and Thessaloniki while providing Bulgaria with links to Ukraine and Central Europe. A local Balkan network was also under consideration in 1995 to connect Istanbul and Sofia with Skopje, Durrës and Bari; while in 2002 Romania and Bulgaria planned two more land connections by 2006 as well as the Calafat-Vidin bridge: again indicating initiative among Balkan states to coordinate their TC infrastructure to improve links with EU. These wider links involve Trans Europe Lines (TEL) with a 14,000km system serving Austria and Germany, extended to the Czech Republic, Hungary, Poland, Slovakia and Slovenia in 1994 with the Baltics, Belarus, Bulgaria, Croatia, Moldova, Romania and Ukraine to follow during the later 1990s. Trans-European Telecommunications (TET) link Bulgaria, Czech Republic, Cyprus, Greece, Hungary, Romania, Slovakia with national sub-networks with access points at Athens, Brno, Bratislava, Budapest, Bucharest, Nicosia and Sofia. The network ensures digital connectivity via submarine cables and other optical fibre systems from overseas countries to connect Western and Northern Europe with Southern and Eastern Europe and the Middle East.

The Rural Scene

This section highlights the special problems in the rural sector for – despite the persistence of obsolete technologies beyond 2000 – the process of improvement is now quite rapid; involving new digital exchanges and local loops installed in conjunction with the long distance cables (sometimes ahead of the national network). The new exchanges are generally in the towns but with some in rural areas (e.g. Bumbești Pitic and Hurezani in Gorj in 1998). Local improvements in

Dobrogea and Galați were secured by the cable laid across the Danube by Ericsson TC Romania, working since 1996 on 1,800kms of optical fibre cable in Moldavia and the south. In the Carpathians links were extended from the Jiu valley to the resorts of Parâng and Straja in 1998. But costs are high and the infrastructure was not always commercially viable. In 2002 the government announced the spending of \$7–8bln over 15 years on a programme sponsored by the World Bank and EBRD for half a million new telephone lines and digital systems and the then IT&C minister (Dan Nica) indicated that ‘dominant operators’ on the Romanian telecoms market might have to pay a percentage of their gross revenues to a fund for the ‘telephonisation’ of depressed, isolated areas.

Foreign Capital has played a very significant role, sometimes acting benevolently through social policy. South Korea helped to modernise the telephone system in the Apuseni Mountains with investment starting in 1997 for an optical cable loop from Alba Iulia to Câmpeni, Baia de Arieș and Aiud with capacity for 30,000 subscribers. The cable was followed by the installation of radio stations to operate a system known as Code Division Multiple Access (CDMA) Wireless Local Loop (WLL), anticipated in 2002. In this way the project extended up the Arieș valley to Gârda where the programme was first inaugurated. The project was financed by a 30-year, low-interest \$12mln loan by South Korea’s Import-Export Bank (10 years grace and a reimbursement period of 20 years) with co-financing from RT and other sources to create a total financial package of \$17mln. In another project in 1998, RT and Lockheed Martin Telecommunications agreed a joint venture to

extend basic telephony to rural areas through satellite-based systems, using VSAT terminals to connect 3,000 villages. Upgrading in the Danube Delta was then realised in 2003 on the basis of the radio waves system installed at Mahmudia, Murighiol, Crişan, Mila 23 and Maliuc, with similar installations to follow elsewhere in the delta. Exchanges were also upgraded in Babadag and Măcin in 2000. Finally, under a contract valued at €40mln Ericsson (Sweden) delivered software for the national 112 system for emergency calls – arising out of the telecomms chapter for EU accession – first operational in Bucharest-Ilfov and in Braşov, Constanţa, Ialomiţa and Prahova at the end of 2003; also the equipment necessary for the connection of exchanges and despatching agents. As an integrator Ericsson cooperated with Motorola Israel and with Romanian firms providing specific equipment and solutions.

Liberalisation of Telecomms

This reform in 2003 (coinciding with a new dialling number scheme) meant that Romanians could choose their operator, while the operating companies could select the best connection solutions and provide their own international fixed communication services. The hope was that competition would extend fixed telephony to half of all Romanians in 10 years compared with a fifth in 2002. It came at a time of technological convergence involving the Global System for Mobile Communications (GSM), Demand Assignment Multiple Access (DAMA) as well as CDMA and broadband (BB): the UMTS (Universal Mobile Telecommunications System) involving cellular public mobile radio technology: the so-called 3G or third generation that has revolutionised

business and paved the way for innovations such as science and technology parks where companies need only bring their own computer to engage with other facilities being provided by the park management. Liberation immediately triggered increased foreign investment and reduced tariffs (especially for international calls: a 'luxury' that became accessible almost overnight). At the end of 2004 RT's 4.53mln customers were complemented by 21,700 using 49 alternative land-line networks (of which 16 provided a national service while another 13 offered landline-mobile links and international services). These competitors emerged in late 2003 with the prospect of commercial battles in 2004 following the negotiation of 'interconnectivity' i.e. access to RT's local loops by Ancom with the responsibility to maximise benefits for users (diversity, quality and costs).

It was expected at this stage that OTE would increase its stake to 54% (with a rising share price at the time) but the state still holds 46% of RT and chose not to sell in 2007 despite a slightly lower price (though it is mooted that the new government will float its holding in 2009) But there is a threat to the company through the fall in subscribers since the peak of 2004: 3.96mln in 2005, 3.40mln in 2006 and 3.03 in 2007 (though higher than the 2.70 once feared, thanks to new management). Following \$1.0bln of investments since 1998 (most recently €400mln for upgrading and new equipment over three years starting in 2003). RT profits rose from €30mln in 2004 to €238mln in 2005 before falling to €55mln in 2006 with a loss of €21mln in 2007 (reflecting falling revenue from €894.8mln in 2006 to €871.9mln in 2007). There were however substantial regional variations in 2005 against a national average of 183.0 subscriptions per

thousand population: Bucharest (355.5) was way ahead of the Centre (197.5), West (194.4), South East (179.9) and North West (172.6), followed by the South (147.8), North East (138.1) and South West (132.1). In terms of total call time – 183.0min/pc on average – Bucharest scored 1,177.8 for the year compared with 489.6 for the West and 410.0 for the Centre; otherwise the rank order was the same: South East (179.9), North West (172.6), South (147.8), North East (138.3) and South West (132.1). But the regions may never catch up because the pent-up demand has now evaporated with the growth of mobile TC. After accelerating from 4.02%/yr during 1985–90 to 6.15% during 1990–7 (2.4 to 3.4mln customers) the rate slowed down to 4.72% during 1997–2003 (3.4 to 4.2mln) and only 0.7% during 2003–5 (4.2 to 4.4mln). Meanwhile mobile users averaged a 121% growth during 1997–2001 (0.2 to 4.6mln), overtaking fixed subscriptions in the latter year, and continued at a healthy 31.2% per annum during 2001–5 (4.6 to 13.3mln).

Within fixed telephony there is a ‘battle of intelligence’ in the software domain since the hardware – the local loops – remain with RT under the government decision taken in 2003 against sacrificing the ‘fat calf’ (perhaps in a bid to stabilise telephone charges in the run-up to the 2004 election). In 2006 alternative suppliers were responsible for 15% (0.65mln) of the country’s 4.4mln access lines. RT innovation continues through a deal with Media Galaxy to distribute RT data/Internet services enabling customers to test equipment before buying BB connections. Magyar Telekom (part of Deutsche Telekom) offered its Eufonika service to RT subscribers (using the RT network to reduce national calls by a fifth and international calls by 40%). The current priority is

halting the drain of customers through new technology with the launch of an integrated landline/mobile service in collaboration with Cosmote although RT losses in this field rose from €27.7mln in 2006 to €34.5mln in 2007. However there was some compensation from Internet access, corporate data services and satellite TV with €500mln invested during 2005–7 to develop the ‘ClickNet’ BB Internet service and also to launch the satellite platform ‘Direct to Home’ (DTH) Dolce TV in 2006. RT also further reduced their workforce to 13,050 in 2005 and 10,000 by the end of 2008 (after previous massive reductions already noted) although they will still have twice as many employees as RCS&RDS and three times as many as Orange and Vodafone.

RT has thus been transformed and although it still dominates the fixed telephony market with a more competitive stance over local and international call charges, this is now a declining business and the company has diversified massively – with €500mln invested during 2005–7 at a time of falling profits – into mobile telephony through a 30% stake in Cosmote (formerly Cosmorom), Internet services (through Click Net, currently offering high speed connection combined with computer games) as well as satellite TV competing with the DTH DigiTV and Focus Sat by RCS&RDS from 2004; also Digital Cable System (MaxTV) from 2005 and DTH Television Group (BoomTV) from 2006; not to mention data center facilities (CyberHost). These new services (especially BB) had attracted an estimated half million new customers by June, 2008. In addition RT now claims some 70% of all fixed telephone subscribers despite keen competition in (including a price-war that lowered charges significantly). Apart from RT the main

players were RCS&RDS and the leading cable TV provider UPC Romania (who lost 100,000 cable customers but gained on the Internet, telephony, satellite TV and digital cable segments). Overall RT lost €21.1mln in 2007 compared with a profit of €55.2mln in 2006 (when revenue was €894.8mln). Fixed line customers declined from 3.40mln to 3.03mln with losses while income from Internet access, data services and satellite TV offered some compensation. On this basis RT managed to increase its subscribers overall from 3.78mln in 2007 to 4.27mln in 2008 because the loss of 56,000 fixed telephone subscribers (3.03 to 2.98mln) was offset by gains in the other domains (0.36 to 0.65mln for Click Net and 0.39 to 0.64mln for Dolce TV); with fixed telephony income declining from €520mln to €456mln while remaining the biggest contributor at 55%. RT had to lower its costs due to the RCS&RDS offer of free fixed telephony for its Cable TV customers while offering the first six months free to new subscribers in order to boost subscriber numbers late in the year. UPS were also expanding aggressively although RT is better known especially in rural areas and has generally adapted well to the new competitive environment: hence its large 'fixed' market share estimated at 70.7% according to Ancom; as opposed to 25.9% for RCS&RDS with a million subscribers and 2.8% (110,000 subscribers) for UPC – leaving just 0.6% (20,000) for other operators.

Other Romtelecom Competitors. Atlas Telecom Network Romania (part of the international group Atlas Telecom Network headquartered in Miami) attempted a national fixed data/voice service using Digital Enhanced Cordless Telecommunications (DECT): implanting radio cells so that fixed

telephones may operate with limited mobility. A start was made in Oradea in 2002 with another 20 cities due to follow by 2005 (initially Bucharest, Braşov, Cluj, Constanţa and Timişoara early in 2004) after signing an interconnectivity agreement with RT in mid-2003. There was an initial prospect of a \$40mln investment over three years from internal sources, but this was revised to €100mln (with loans and investment funds) in the hope of aggressive expansion with 2,300kms of FM cable and 6,000kms of copper telecom cable to gain a million clients for its service packages in three years. Meanwhile, through a \$350mln investment from the USA Telemobil launched CDMA services in Romania's large cities, with the prospect of reaching 95% of the population. This is a type of fixed telephony linked with Zapp (formerly Telemobil) that includes WLL technology giving customers access to a quick data transmission system. Reference should also be made to Romania Telecom Networks Services: a joint stock company licensed in 2003 to exploit the public network of data transmissions through packages by Rompac (part of the France Telecom Transpac Europe network): the main activity is developing and marketing a public network of data transmissions. Also Euroweb: a 2,500km optical/data transmission network with SDH equipment from China's Zhongxing TC Equipment Corporation (ZTE), comprising 14 nodes in Romania (e.g. Arad, Braşov and Oradea) including capacity for Hungary-Romania-Bulgaria-Turkey transit.

Radiocomunicații, a national company, entered the fixed phone market in 2003 with attractive tariffs for long distance calls after receiving a \$100mln US credit in 2001 to update and enlarge the Cheia (Prahova) digital platform that relays

simultaneously three TV channels with national coverage. DAMA equipment now facilitates integration into the international services network through satellite (Intelsat) and enables Romanian TV to reach USA and the diaspora. Development of a network to carry audio, video, data and Internet signals opened the way to sales of fixed phones and high-speed Internet and teleconferencing systems of high video quality with web support provided by a national radio network at 26GHz frequency (through a pilot project launched in Bucharest, that was extended to other towns). Cheia also provides a satellite TV link at lower prices, while in 2002 DAMA reduced telephone call costs, with possible access to rural regions through satellites. In 2004 this initiative led to the Rartel joint venture with Telespazio of the Finmeccanica Group to offer satellite TC services including a €1.0mln SIMIN ('Sistemul Meteorologic Național Integrat') network envisaged in 1999 for the National Meteorological Administration and achieved by the American Lockheed Martin company with an investment of \$55mln during 2000-3 involving 10 radars with data processing in Bucharest. Another network was provided for the National Institute of Earth Physics to transmit seismological data; along with a €5.0mln satellite orbit control contract for which the latest generation antenna was installed at Cheia. Finmeccanica are also present through Eltag who provide information for the banking and financial sectors as well as IT security solutions.

Telecomunicație, the state railway TC agency, already serves the railway network with an analogue network of 10,500kms (including 3,500 aerial) that could become a powerful competitor with its own services in railway stations as the c.3,500km system of fibre optics in five rings

(2,510kms underground and 1,020 aerial) is undergoing a \$57.8mln extension to create a nationwide coverage of some 7,500kms during 2003-10: Arad-Baia Mare and Calafat-Craiova-Alexandria in 2004; Medgidia-Tulcea and Sf.Gheorghe-Dej in 2006; with Bacău-Piatra Neamț, Caransebeș-Turnu Severin, Sibiu-Piatra Olt-Pitești and Verești-Botoșani in 2008 (Crăciun 1997). The problem of high rentals for access to RT's local loops could be overcome by loops covering stations and yards and well as international links. The system is already used for the railway infrastructure project IRIS and is also targeting non-railway clients e.g. informational health and legal systems, with integration of voice, data and image services. Collaboration with the cable maker Draka Comteq (Finland) is another possibility. Meanwhile, Transelectrica, with a national network of 2,500kms based on fibre optics, went into Internet, telephony and network services with its Muntenia Sud subsidiary running a pilot in an apartment building and an educational institution to test the technology needed to sustain BB transmission via low/medium voltage aerial power lines.

Poșta Română (PR) emerged in 1991 (like RT) through the breakup of PTTR and became a national company in 1998. A delegation to China negotiated a partnership over the Postelecom project with China's largest TC equipment provider (ZTE) with financial support for China Unicom technology by the Banat-Crișana and Oltenia State Investment Funds as well as the Romanian Commercial Bank (BCR) and China's Export-Import Bank (with the latter providing an \$80mln loan for equipment). Hoping to compete with RT on price, PR has been improving its efficiency with postal deregulation in 2002 bringing an end to monopoly over its

'reserved services' of traditional mail, home/overseas postal orders and telegrams. Following a decision in 2001 to introduce IT in all urban offices, Internet access was made available at 280 offices by 2003 and subsequently in 500 including centralised rural offices. Computerised offices ensure quick domestic and international money transfers, including the Western Union money transfer service where IT has been introduced (plus payment by telephone in other locations, largely in rural areas). The Eurogiro money order service can also be used to send money in both directions where the necessary IT is available, while online money orders provide lei transfers within an hour. The EU 'acquis' also had implications for PR and an increase in service quality materialised through Romania's initiative in 2002 to join the Association of Public Mail Operators in Europe ('PostEurop') in establishing guidelines for countries in the race for accession. PR has now won 80% of the domestic fast courier market through 'PrioriPost' and 'UltraPost' services aligned to European standards and providing delivery within 72 hours. PR is now a profitable business with 81.5mln.lei profit in 2000 (up 2.85 times on 1999); it has received €50mln from EBRD to help modernise infrastructure to handle more letters/parcels and while reducing the time taken.

MOBILE TELECOMMUNICATIONS

Although it was always assumed that RT would retain a virtual monopoly in basic telephony there was an expectation of keen competition over value-added services, data transmission, mobile phones and paging. Hence in June 1996 (long before RT privatisation was launched) the government invited tenders for licences to install and operate a new

cellular business involving GSM technology. Licences were issued later in the year to the two winners that were both consortia including an important local component: Mobilrom involving France Telecom (France) with four Romanian companies: Alcatel Network Romania, Computerland, MediaPro and Tomen Telecom Romania; and Mobilfon that brought together Air Touch Communications (USA) and Telesystem International Wireless (TIW) of Montreal (Canada) with three Romanian companies: Isaf, Logic Telecom and PR. As Romania was brought into the GSM family in 1997, territorial coverage in the first phase focused on the key cities of Bacău, Braşov, Bucharest, Cluj, Constanţa, Craiova, Galaţi and Timişoara; also the more important roads: Giurgiu-Bucharest-Piteşti-Sibiu-Arad-Nădlac; Bucharest-Braşov-Alba Iulia-Cluj-Oradea-Borş; Bucharest-Constanţa-Vama Veche; Piteşti-Craiova-Timişoara-Moraviţa; and Bucharest-Buzău-Bacău-Suceava-Siret (with the two branches: Suceava-Iaşi-Ungheni and Buzău-Brăila-Galaţi). The second phase brought in all the towns along these routes not already covered; while the third phase covered 65% of Romanian territory including all cities of 100,000 population and the national roads linking them.

Conflict over use of 1,900/1,800MHz frequency was solved by RT/Cosmorom exclusivity until the end of 2002 (as included in the RT privatisation contract of 1998). But rapid development followed the launch of a CDMA digital 450MHz network late in 2001 so that both GSM and CDMA technologies were now offered by four operators, of which two had wide coverage in Romania as well as roaming services in a large number of countries. The market then encouraged third-generation (3G) BB technologies with Internet

access and the government announced in 2003 that the IT&C ministry would sell four 3G licences through international tender. Licenses and authorisations are technologically neutral, allowing (e.g.) the offering of data on cable television (CATV) networks or creation of hybrid networks with mixed utilisation for voice, data and video distribution. Two foreign companies were poised to launch BB digital networks during 2003–4: Las Americas Broadband (formerly Info America) and Dick Clark International Cable Ventures sought to develop infrastructure for BB digital communications, while Sumitomo (Japan) wanted to test a 3G mobile system in Romania. It was always assumed that the growth of mobile phones would be quite rapid and from an initial 50,000 cell phones in 1996 the number was predicted to grow quickly to 200,000 and then more slowly to half a million after ten years. But with the explosion in technology, plus the affordable terminal prices and the delay installing fixed line services these expectations have been exceeded.

Mobile Phone Ownership

The number of mobile phones rose to 1.35mln at the end of 1999, when Romania stood with Lithuania at the level of 5–10% penetration: above Albania, Bosnia & Herzegovina, Bulgaria and Macedonia, but below Czech Republic, Hungary, Latvia and Poland (10–20%), Estonia (25%) and Slovenia (32%). The 2.0mln mark was passed in 2000 and then mobile subscribers jumped 121% during 2000–3 (from 2.8 to 6.2mln) compared with 10% for fixed telephony (3.9–4.3mln) and 38% for cable (2.70–3.75mln). New mobile customers exceeded new fixed subscribers by 10:1 during the first half of 2002 (621,700 against 60,300) and total

mobile phone users overtook the fixed sector by the end of that year when RT had 4.09mln compared with 4.50mln for the four mobile companies (Mobifon, Orange, Cosmorom and Telemobil). The gap widened to 4.2 and 6.0mln at the end of 2003 when over 90% of the country was covered by mobile phone signals: Connex (Mobifon) and Orange now had 5.9mln, with 150,000 for Zapp and 100,000 for Cosmorom. Estimates now suggested 10.0mln mobile users (half the population) by the end of 2004 and 12.0mln for 2007, although this would involve many people having two or three phones each, given that 40% of mobile users in 2003 (when €200mln was being spent on phones and accessories) were changing every two years: half them every year and another quarter (5.0% of all mobile users) every six months. Mobiles were certainly in the driving seat, helped by competition and ownership structures. And given the practical value of the system for business and private use (not least in rural areas with capacity problems in the fixed sector), “the mirage of permanent connection to the ‘global village’ turned into reality” (Iacob 2001).

3.0mln phones were sold in 2004 – especially Nokia, Siemens and Sagem – but despite client confidence, the real situation was not as positive as the IT&C ministry suggested due to falling profitability (apart from the major companies like Connex and Orange) that seemed likely to push second-line players into alliances and encourage the maintenance of existing applications upgraded with small investments. In 2004 many operators had huge debts and faced the prospect of fierce battles between alternative operators and service providers for slices of the market. The wireless sector lost some momentum in terms of 3G success but the

mobile operators realised that the true 'gold mine' lay in data services. International financial pressures seemed likely to trigger massive layoffs by the major multinationals like Ericsson, Motorola, Nokia and Sony. With elections looming at the end of 2004, commentators saw a nervous government caught between RT's 'blackmail' – seeking to restrict access to the local loop to those clients that did not constitute a real threat to its business – and Ancom pressure not to allow RT to raise its fees on the assumption that a rise in subscriber prices would significantly reduce the number of votes for the governing party. However, penetration by mobile phones shows Romania with 103.2% in 2008: below the EU average of 119.0 but with seven states (including Belgium and France) with a lower rating (Ancom 2009, p.45). But there are much higher levels if all prepaid SIM cards are taken into account: 14.4mln in 2005 to 28.6mln in 2008: a rise in the penetration rate from 66.5 to 133.0% (indicating that a significant number of users have two or more phones). However even the active SIM cards, plus subscription customers, indicate a growth in penetration to 113.8 from 66.5 in 2005 (12.6 to 24.5mln).

The Mobile Companies

There are five companies to consider with four which are truly national: Cosmote and Zapp (Telemobil) along with Orange and Vodafone now cover virtually the entire population, while RCS&RDS manage just 50% (22% in terms of territory compared with c.90% for the others). The companies do not all use the same technology. CDMA is used by Telemobil while GSM and GPRS (Global Packet Radio Services) are used by Cosmote, Orange and Vodafone. EDGE (Enhanced

Data Rates for Global Environment) is used by Orange while UMTS involves all five except Cosmote (Ancom 2009, p.37). However, it is difficult to over-estimate the importance of two companies that must clearly be counted within Romania's top ten culture-changing investors: Mobifon (Connex), now rebranded as Vodafone, with Ted Lattimore as President, and Mobilrom (Orange) under Richard Moat as General Manager. They took out 900Mhz licences at the same time and have spearheaded the mobile communications revolution with mobile banking and e-mail as well as roaming and EDGE. In 2000 Mobilrom obtained the ISO 9001 certificate – a national first for a Romanian GSM mobile telephony company – recognising the company's record in the design, management and supply of GSM TC services across the country, including landline-mobile links and scope for downloading Java Games. The company had 3.31mln customers in 2003, 4.93 at the end of 2004 and 6.0mln in mid-2005 (ahead of Connex with 5.25mln) and 10.20mln in 2008; while its profits were €238mln in 2003 and €335mln in 2004 with rising turnover (€467–624mln) and investment (€111–145mln). They started to introduce 3G gradually in the major cities in 2006, following experience in Western Europe with EDGE as the national complementary technology. The two companies (along with Cosmote's 2.39mln) had total of 22.24mln customers at the end of 2007.

Mobifon/Connex now Vodafone

This company started trading in March 1997, with its trademark Connex, and picked up 140,000 users in one year as the first company in Romania to offer state-of-the-art digital mobile telephony. With funding from ABN AMRO bank and EBRD it set

out to cover five new roads each month using solar and aeolian energy for data-transmission stations (found to be much more reliable than traditional electrical energy). A typical early station of 1998 was on a mountain near Sinaia covering a 20km section of highway and requiring 4.0Kw daily. But the efficient Meteriz data-transmitting station at 720m between Orșova and Băile Herculane was 25 times larger: serving a third of all the company's connected clients, it was described after its opening in 1999 at the largest European GSM station using solar and aeolian energy, generating annual savings of over \$300,000. It was an interesting pointer to the future for Romania's mountain regions, being endowed with the latest American equipment: 80 solar panels and two eolian generators of 10kW each, with energy stored in 72 accumulators to ensure the station's continuous operation needing 100kW daily with wind and sun complementing each other. For phone sales Connex worked with the Greek Germanos Company that started selling batteries in Romania in 1996 before expanding into a chain of 66 shops in 41 towns by 2003 as the independent company Germanos Telecom Romania from 2000. It has also been well-served with software from the Drutt Corporation (a leading global player); while its public image was raised by support of culture/education and community environment projects.

Transition to Vodafone. The company was granted a mobile phone licence for 1,800MHz in 1999. Subscribers increased to 3.46mln at the end of 2003 and 4.91 a year later when profits were \$226mln. In 2005 the company was the first to offer advanced 3G services to mobile users for a smooth, cost-efficient path from the second generation GSM

network; with Ericsson selected as the equipment and services supplier (for core and radio network equipment and system integration) to roll out the new WCDMA (Wideband Code Division Multiple Access) network. The Nokia 6630 was offered at its 3G launch: the world's smallest megapixel phone for both the GSM and W-CDMA networks; and the first in a series of 3G-enabled handsets providing e-mail (including downloading of attachments at speeds of up to 384kilobites/sec, mobile BB access to multimedia content, live video streaming and video conferencing. Coverage was initially restricted to Brașov, Bucharest, Cluj-Napoca, Constanța, Craiova, Iași, Ploiești and Timișoara (March 2005) followed by Arad, Galați, Oradea, Pitești, Sibiu and Târgu Mureș later in the year. Meanwhile rebranding occurred as Vodafone (UK) acquired the \$3.0bln interest of TIW (Telesystem International Wireless) in the largest takeover in Romanian history to increase their share from 20 to 99%. Vodafone have now integrated Mobifon into its international operations to provide a wider range of services and generate more aggressive competition; they also have an interest in Oskar (Czech Republic) alongside their existing investments in Hungary and Poland. This is good for Romania in the sense that the cellphone market is now contested between two of the three leading world businesses: Vodafone and Orange; and certainly Romanians seem pleased that Vodafone is interested in them!

Although rebranding involved the transitional stage of Connex-Vodafone, pending a court case over the use of the Vodafone name in Romania, the company is established as the clear leader with 7.71mln subscribers at the end of 2006 (0.30mln on BB), with improved service quality and pressure to

attract as many 3G technology clients as possible (97,000 at the time). A further €200mln of investment was earmarked for further modernisation and new stores. New attractions include the offer of Blackberry services (Enterprise/Internet/ Business Solutions) at 3G speed for \$18–49/month; also facilities through Citygroup to send money abroad (competing with Money Gram and Western Union). And since all the mobile companies have their own 'dedicated' High Street suppliers serving the public, there is always the option of sharpening competition by acquiring chains of shops that could be weaned away from the competition. In 2007 Vodafone acquired the Petrocom chain of 57 shops as well as 66% of the former leading Orange partner Proton Technologies (started by in 1999 by Gabriel Sandu, then a young man of 23). Proton have 73 stores (being doubled by Vodafone to 160) mainly in Moldavia where mobile penetration is relatively weak (hence offering good potential for future growth) and Sandu may have decided to sell after failing to acquire the Orange dealer Vegastel (based in Botoşani): another Vodafone takeover target at a time when independent GSM companies (like Tel Sim GSM which has been taken over by Germanos) have taken the exit option given the maturing market and a slower growth in client numbers. Orange meanwhile are increasing their own chain of shops to 86 (it could reach 100) and their arrangements with the Fonomat chain (which has also acquired the 'Plus GSM' chain established in Cluj by businessman Razvan Ciuc): by contrast Vodafone does not have partnerships with GSM retail chains favoured by Cosmote as well as Orange. Indeed Orange have around 1,000 including a substantial chain of 130 owned by GSM

Retail and developed by Silvia & Zsolt Fodor who started in Cluj in 1997 (and were rumoured to be considering disposal of the business – and also their 'Mobile Distribution' company selling Orange and Vodafone cards – in order to realise €40mln to invest in real estate).

Telemobil (Zapp Network)

This was the first cellular telephony operator on the Romanian market with an NMT licence in 1992 and it launched the first 3G mobile network on 450MHz wavelength based on CDMA technology at the end of 2001 in 15 towns and along major roads. But in 2002 this technology was introduced under the new name of Zapp Mobile, following a \$94mln loan agreement with Creditanstalt, Raiffeisen, Citibank Romania and Black Sea Trade & Development Bank to develop the network and improve services with the hope of having the same cover as GSM operators within six months. It is the only mobile operator providing mobile subscribers with voice and high speed data (up to 2.4 megabites/sec), communications services and multimedia. It uses Starent ST16 Intelligent Mobile Gateway by the American Starent Network Corporation (SNC) – 'the preferred next generation solution for worldwide mobile operators' – to provide BB Internet services. The Zapp-SNC partnership shows how CDMA technologies enable 450MHz analogue operators to use existing infrastructure to operate advanced wireless services. Landline-mobile links are also provided. Zapp has progressed through four annual phases to cover 78% of the territory and 90% of the population in 2005 (240 towns, 1,500 other localities and 6,300kms of national roads) with turnover rising from \$14mln in 2002 to \$52mln in 2003 and

\$93mln in 2004. 2006 saw Telemobil awarded one of the two remaining 3G licences (for 15 years extendable for 10 more) while the other winner was RCS&RDS with 'DigiMobil': the licences related to the use of radio frequency for provision of 3G public networks, following the World Radiocommunications Conference of that year. With particular strength in the corporate sector, the company reached 0.5mln customers in 2007 with a mobile service in 19 cities (the larger county centres) which has now advanced to 24 and is set to increase to 62. Meanwhile it continues to operate a nationwide system using CDMA technology. As part of Inquam Romania (owned mainly by the American company Qualcomm) there has evidently been difficulty getting capital for promotion and network expansion, but the situation has improved since a 50% stake in Inquam was taken by the Arab group Saudi Oger owned by former Lebanese prime minister Rafis Hariri. With €70mln invested during the first half of 2009 alone the company has seen a big increase in business for mobile Internet use and data services. It is now working with Fly Taxis (Bucharest) to provide computers with Internet access inside taxis.

Cosmorom

At the time of RT privatisation OTE launched a new 1800MHz network of mobile phones under the name Cosmorom (with RT the majority shareholder) modelled on the Greek operator Cosmote Mobile TC (in which OTE has a 70% shareholding). As Romania's fourth mobile GSM operator (with a different frequency from the others) it was hoped that Cosmorom would repeat Cosmote's success with initial availability in Bucharest, Braşov, Călăraşi and Constanţa and the

connecting roads (i.e. the Ialomiţa and Prahova areas) with national coverage in 2002. The network was launched in May 2000 using the Ericsson T10 telephone with a \$10 rechargeable card (costing \$230) and the 'One Touch' Alcatel telephone, also with a \$10 rechargeable card (priced at \$150). RT invested \$800mln in 2001 to modernise mobile communications and develop a national high-speed data transmission infrastructure: \$250–300mln to upgrade Cosmorom mobile telephony and the rest for a high speed data transmission network. But the project was financially disastrous with mounting debts that pointed to closure in 2003 (when there were 87,000 customers but €190mln liabilities) and losses continued with a further €3.0mln during first half 2005. However Cosmote remained undaunted in 2003 and envisaged a substantial relaunch over three years.

Through Cosmote the OTE stake in Cosmorom was increased from 54% to 70% (with the rest held by the Romanian government) by a €520mln programme for share purchase, capital increase (voiding debts) and investment programme at a time when the market was expected to double from the then 10mln customers in five years with Cosmorom looking to achieve to a 10% share by that time. The \$450mln three-year relaunch on the GSM market with a \$450mln investment was intended to extend coverage from 55% to 70% of the country during January-June 2006 (to reach 90% of the population) with the intention of competing through lower charges: the rate of €0.16/min. any time of day (€0.10 for a favourite number and prepaid card) claimed to be 47% below the competition. In 2005 income increased by a fifth to €8.0mln from 50,000 clients but operating losses of €20mln were sustained. The company faced a tough assignment

with GSM already reaching 60% of the population. But it launched such services with a 3G licence in 2006 with a particular focus on rural areas where new masts transformed the situation in some remote areas like Nădrag in a deep valley on the western flank of the Poiana Ruscă mountains. But Cosmote appreciated the importance of shopping chains and therefore acquired Germanos in 2006. They also provided stores at all RT branches (partnership with a fixed operator being another development ploy) and halved their international call charges to Europe, North America and Israel. While their target of a million customers by the end of 2006 (against the 0.53mln registered in June 2006: confirming third place) initially seemed ambitious the number actually 'shot up' to 2.39mln at the end of 2007 (though the company's losses increased to €34.5mln from €27.7mln in 2006): two-thirds of their new clients were attributed to a stronger High Street presence. A €36mln expansion in Cluj county followed in 2008 and other projects are in the pipeline. Cosmote's robust growth in 2008 – largely responsible for pushing the overall national penetration rate up from some 110% to 130% – was also geared to the pre-paid sector (whereas Vodafone and probably Orange too are looking more to post-paid business). Cosmote have now continued their expansion with the purchase of Zapp (and its 3G licence) for €61mln in June 2009.

General Assessment

The mobile system has certainly been a great success in what is an emerging market constrained by low purchasing power and hence low demand for higher margin value-added data services. Mobile phone sales were poised to reach a billion in 2006 with Nokia (Sweden) in the lead with 35%,

followed by Motorola (USA) with 20% and Samsung 12%; followed by Sony Ericsson (9.0%) and LG Electronics (6.5%). BB is good for the cities where companies are agreeing over areas for quality services and there is also international cooperation across the Balkans from Greece and Turkey to Romania and Croatia to coordinate and combine networks for a unified BB market in the region. But the 'big two' companies are clearly not having all their own way despite virtually 100% penetration by 2007 for there is scope for improvement (e.g. more could be done to improve services in rural areas where signals may be poor in the valleys and people have the incentive to climb hills) not to mention the option of poaching customers through improved service quality e.g. data services which is a growth area accounting for a tenth of Orange's revenue in the early part of 2008. Despite the high entry cost for competitors Cosmote have shown the way by winning 15% of the market over two years with their 'i mode' offering many applications with the Zapp purchase now marking a further advance. Fixed operator RCS&RDS now have a €100mln plan for Bucharest and 15 provincial cities. The latest figures have Orange on 9.31mln and Vodafone on 8.58 followed by Cosmote with 3.00 and Zapp with 0.50. But the economic slowdown is now taking its toll with Orange suffering its first year-on-year decline in the first quarter of 2009 with turnover down 14% – due to lower consumption and lower prices as well as new interconnection and roaming regulations – despite a slight increase in clients from 10.09 to 10.11mln (though down on the last quarter of 2008). But until this recession however mobile telephony was extremely profitable and no doubt strong challenges were mounted against the two leading

companies for this very reason; plus the likelihood of an exaggerated accessibility rate – perhaps in reality no more than 70% in 2007 – pointing to much further growth potential.

The business is contributing to the Romanian economy through the manufacture of equipment; most evident through the controversial relocation of Nokia from Germany through a €200mln mobile phone factory and development centre at Teterom Industrial Park (Jucu near Cluj-Napoca) where 3,500 will eventually be employed at the ‘Nokia Village’ including component suppliers. A less satisfactory aspect of the mobile revolution has been the trade in forged cellular phones that amounted to c.100,000 in 2000. They are brought in from Western Europe but are not suitable for the operating frequencies used by local companies. So the imported phones are decoded in Romania but usually incorrectly and without the manufacturer's authorisation, so their lifespan is shortened, especially in view of the lack of repair/spare parts facilities. Not surprisingly mobile companies are unhappy over black market activity which took 56% of the market in 2000 plus 20% from the grey market. There is an obvious need to enforce the law, since Romania lost an estimated \$13mln in unpaid taxes due to black market activity in 2001 alone.

Mobiles have certainly made a tremendous difference, especially in remote areas (notwithstanding the difficulty of getting satisfactory signals). The initiative of the school in the remote commune of Arieșeni – in the Apuseni Mountains (with increasing importance for winter sports) – in compiling a mobile phone directory in 2004 made for an interesting comparison with the RT fixed phone directory to establish the relative importance of the two systems. Across the

commune there were 233 mobiles and 126 fixed phones for a population of 2,019: averaging 11.6 mobiles and 6.2 fixed phones per 100 inhabitants (total 17.8). But the figures of 42 and 28 for the central village (with a population of 98) produced rates of 42.8 and 28.6 per 100: total 71.4; while for an inner ring of outlying settlements (Avrămești, Fața Cristesei, Fața Lăpușului, Galbena, Izlaz, Păntești, Ravicești, Stei and Vanucești) the 110 mobiles and 99 fixed phones for a population of 1,126 population produced much lower rates of 9.8 and 8.8 per 100: total 18.6. And for the outer ring (Bubești, Casa de Piatră, Cobleș, Dealul Bajului, Hodobana, Pătrăhăițești, Poienița, Sturu and Vârtop) the 81 mobiles and 21 fixed phones for a population of 795 produces an even lower overall rate of 12.8 but with a much greater disparity between mobile and fixed phones (10.2 against 2.6) in an area where the latter system is very poorly developed and the cost of prepaid magnetic cards is particularly burdensome. Thus while the availability of phones declines from centre to periphery the importance of mobiles increases quite remarkably from 40.0 per cent of the total in the centre, to 52.6 per cent for the inner villages and 79.4 per cent in the outer ring. Nationally it is estimated that there may be 3,300 villages with no fixed telephone access at all (or outdated services at best).

CABLE TELEVISION (CATV)

This has proved to be another launchpad for the IT&C revolution. CATV developed explosively, with about 70% Romanian capital, to attract 3.5mln subscribers by the end of 1999 but VAT caused a slight depression to 2.7mln in 2001 (despite attempts to neutralise this through bigger discounts to low-income customers). However there was a

revival to 3.3mln in 2003 – 16% of the population compared with 14% in Hungary (1.4mln), eight in Poland (3.1mln) and the Czech Republic (0.8mln) – and 4.0mln in 2004 (allegedly involving half the households in the country) when the business accounted for some 10,000 jobs. At present some 80% of all TV viewers use cable and the system reaches almost exactly half the population: 49.3% of households on average during the four years 2005-8 but 70.2% for the urban areas and 24.8% for rural areas (Ancom 2009, pp.70-1). The trend has been encouraged by liberalisation and considerable national/international investment. The Romanian Professional Association of Cable Communications formed in Cluj in 1994 tried to improve the quality of service that includes the HBO TV Channel. Cable companies have networks in all cities and in many rural areas. 3,318 cable licences were issued in 2003 (just 51 in 1992) with 78.5% urban penetration but only 17.0% in rural areas where signal theft is rife as poor people try to tap into aerial cables, although this should be a less of a hazard in future because the EU requires buried networks! Reflecting economic strength and western contacts, Transylvania leads in CATV with 30% of all the companies in the country, including Romania's first company TVS (Oradea) which started in 1991. All Transylvanian towns have cable networks and some cover rural areas (with satellite TV common in villages that lack this facility). Much upgrading is now underway for cable provision of Internet access and fixed telephones. The cable TV business is going digital: accounting for 8.6% of households in 2006, 24.1% in 2007 and 32.1% in 2008 (Ancom 2009, p.73). This is down to the DTH satellite system which accounted for 38.1% of the 5.65mln cable subscribers in 2008

but only 14.0% of a total of 4.39mln in 2006 and 4.0% of a total of 3.79mln in 2005. As a result the conventional cable subscribers are now declining from a peak of 3.78mln in 2006 to 3.49mln in 2008 (Ancom 2009, p.67).

Romanian Cable Systems (RCS&RDS)

RCS has the largest customer base following its takeover of Terrasat, established in 1992–4. But it is indicative of the system's ITC potential that Romanian Data Systems (RDS) emerged in 1998 to specialise in data transmission and Internet services (and the company then became RCS&RDS). Following a project started in 2000 for a national optical fibre network of 4,200kms (1,000kms of which was built by 2003), the company has become an integrated communications provider and has invested \$100mln to upgrade and expand its CATV network – initially in Arad, Braşov, Bucharest, Constanţa, Iaşi, Oradea, Sibiu and Timişoara – to improve TV signals, increase the variety of TV channels and provide Internet access. In 2003 the company offered packages of integrated services and Internet access through optical fibre, coaxial cable and radio modems; with phone call services via the network to follow. Meanwhile Tandberg Television has provided – through competitive tender – an advanced digital video and TV delivery system to RCS. This involves the new Romanian DTH ('Direct to Home') state-of-the-art 'Digi TV' satellite service started at the end of 2004 enabling RCS to launch 32 channels via Intelsat to complement their cable network that now supplies TV, Internet and telephony to almost a million customers. Meanwhile the digital TV channel 'Focus Sat Romania' launched in 2005 hopes for 200,000 DTH customers during 2005–7 (including

villas, vacation houses and small hotels); while many other companies are now modernising with fibre optics by gradually replacing coaxial cables in order to facilitate service packages covering TV channels, Internet access, data transmission and fixed telephony. The cost of telephone and Internet services was initially very high (in 2003, six companies won two-thirds of the market) but as the Internet Service Providers (ISPs) expand their costs have fallen while quality has increased. With a good national coverage, high density and ability to offer service packages, CATV operators seem poised to play an important TC role.

Astral and UPC Romania

This is another major player and it now equals the RCS quarter share of the market. Astral's VOIP (Voice Over Internet Protocol) system – packaging voice as data in transmission by Internet – makes full use of infrastructure developed over the past decade and earned the company a \$9.0mln profit in 2003. The business developed through the initiative of a small company that began providing CATV from an apartment in Cluj in 1992 before expanding 'from one town to another' installing cable for TV and Internet access. The privately-funded cable network grew to 700,000 clients over 10 years (400,000 having bi-directional cable by which voice services could be provided). Then a \$20mln investment attracted from the AIG New Europe Fund was used to acquire both cable and Internet operators (the best known were Kappa and DNT) so that when the cable business reached a critical mass the focus switched to Internet; using the same technical solutions to optimise costs and human resources and make greater use of the infrastructure when CATV failed to generate increasing profit.

Liberalisation took TC infrastructure investment to \$6mln in 2002 plus a further million for networks and software following the decision later in the year to go into telephony. Investment Fund shareholders accepted that VOIP was the lowest risk solution and the financing contract was signed by EBRD. Solutions for quality configuration and adaptation software – and connections to the national telephone operator – were solved by April 2003 and the service was made public at the end of that year. Astral has thus repositioned itself from cable company to Internet supplier and is now an integrated TC provider (covering CATV, Internet and local/long distance/international telephony) initially targeting 20,000 Internet users with voice and data services. The whole strategy relies on BB technology.

A further element in the saga concerns the American company – Liberty Global International's UPC – which set up UPC Romania to gain a tenth of the market (including the 2006 acquisition of half of 'Focus Sat' digital TV) before taking over Astral (and 13 other local company networks) in 2005 to become undisputedly the leading Romanian provider of cable and satellite electronic communications. This now represents one of the greatest US investments in Romania (\$500mln) and requires substantial office space: hence the takeover of the Nord office building in Bucharest. The 'triple play' business of telephony plus various Internet and programme packages through analogue and digital CATV led to the new Astral Telecom 'Astral Online Ultra' offering new generation services – the fastest Internet connections (as well as digital telephony and CATV) at competitive rates – starting in Timișoara before extending to all major cities. This involves ECI Telecom who have

installed a 'multi-service provision platform' (MSPP) within the Astral Telecom network. Now known as IPC Romania and owned by UPC Holding in The Netherlands, the company claimed 1.34mln clients at the end of 2007 (in a video segment combining the declining cable business and the expanding digital cable) and expect competition from three or four such companies in a few years. One of these is certainly RCS&RDS (43% owned by Zoltan Teszari) reacting to Astral's initiative with the prospect of more specialised and sophisticated services to make the entire market grow. In 2007 technology was being modernised with the help of Broadcast Network (UK). Another key player is RT who are anxious to compensate for the decline in fixed telephony with Dolce TV as already noted. And we have also referred to two other DTH providers are MaxTV and Boom Satellite TV launched in 2005 and 2006 respectively: the latter offers its own channels and passed 200,000 clients by the end of 2008 (a 300% increase during the year with €18.5mln from UniCredit Tiriatic for development).

IT: THE CHALLENGE AND THE GOVERNMENT STRATEGY

In this final section attention moves to the IT domain in which Romania has scored considerable success considering the relatively low average wage and consumption levels. Per capita spending in this domain was only \$25 in 1999 compared with 1,215 in Western Europe with vastly more personal computers per unit of population and labour: one for every 64 man-hours of labour compared with 970 in Romania and 1,141 in Bulgaria. Hence the challenge was to assimilate the new technology in the run-up to EU accession even though costs were

high (Internet access could cost over half the average wage), the digital economy was broadly perceived as part of a 'distant future' (especially in the context of the obsolete technologies in most rural areas) and most politicians had other priorities even at the start of the new millennium. By this time much was happening as a result of international conferences such as the Prague 1996 'Forum of the EU and Central & Eastern European (CEE) countries on the IT Society' while the 1998 enlargement of the G7 (bringing Russia into what became the G8) stimulated new projects such as the Global Emergency Management Information Network Initiative (Gemini) for a worldwide information network on disasters, as well as multimedia access in the cultural domain. Romania's centre-right government of 1997–2000 presided over RT privatisation and the inauguration of mobile systems, along with liberalisation of services and strict delimitation of monopoly in line with commitments assumed through the WTO as well as an independent regulatory strategy for IT&C branch. But there was also a national strategy and a promotional group (in recognition of the need for higher priority in line with transition states that were leading in the race for accession) and government money was provided to fund the 'Romania IT' brand, as a Public-Private Partnership led by 'Coaliția 21'.

US Investment was secured in the end of the 1990s and in 2000 Romania was linked with the US 'Internet for Economic Development Initiative' helping emerging economies to use the Internet for economic development, improved living standards and an accelerated flow of ideas. Thereupon USAID expanded its support for the promotion of software development and manufacturing opportunities to

American companies and entrepreneurs through the Romanian-American Capital Trade & Development Group. USAID also assisted IT associations in advancing competition worldwide, education and training for entrepreneurs and expanding e-commerce and e-business in Romania. And there was also a focus on developing IT in remote areas including micro e-commerce, tele-medicine, distance education, environmental surveillance and access to government services. Also in 2000 Fujitsu Siemens Computers donated mainframe computers to technical universities in Bucharest, Cluj and Timișoara to help train specialists. And the Romanian-French Information Centre (Romfra) in Alexandria started a project on 'Information Technologies: A Bridge to the Third Millennium' on the basis of tendering organised by the South Muntenia Regional Development Agency.

The Information Society

The ideal of the 'societatea informațională' was energetically promoted by the 2000-2004 Năstase government (through IT minister Dan Nica) recognising the potential for job creation and dynamism affecting all economic sectors, administration and culture. A 'Group for the Promotion of IT in Romania' was established under the prime minister with the theme of 'The Knowledge Society 2001–2010'. Romania's national strategy was to introduce IT into the education system; create cyber-centres and technology parks; provide a national virtual library and IT centres easily/freely accessible to citizens; and secure operational legislation and an institutional framework with a unitary character integrated at the scale of entire national economy. Other issues were the development of

communications in rural areas and upgrading radio/TV networks. A significant achievement was the inauguration of websites in 2003 for government information (e-guvernare.ro) and public acquisitions (e-licitatie.ro). The latter has certainly simplified interactions between administration and business. Seen internationally as good practice, electronic procurement has exerted a positive impact on bureaucracy and helped the struggle against corruption. Meanwhile, application forms are available electronically (autorizatiianta.ro) e.g. for customs, driving licences and road transport goods authorisations (with the latter facility widely used by international transporters); also security guidance for administrators through the Centre for Expertise & Response to Security Incidents (ceris.ro) and the anti-fraud project to protect suppliers and consumers (e-frauda.ro). The effort in education was continued with a programme to connect all schools to the Internet by the end of 2002 and in connection with the subsequent development of school computer networks a \$200mln scheme was launched for high schools and secondary schools in 2004. A national IT centre equipped with high-performance computers became involved with universities, research institutes and industrial partners in 2001 (with smaller networks provided as a virtual environment for education).

In addition to leisure activity, there is much business-related use of computers and the Internet (including 75% of SMEs, a quarter of whom get information from government this way) while 'ro' domains increased from 16,600 to 62,000 during 2000–4. Electronic commerce doubled in value from €2.5 to 5.0mln during 2002–3 and reached €6.25mln in 2006 (mostly linked with CATV and mobile phones) while constrained by

limited use of bank accounts and credit cards. Online shopping opportunities include Marius Ghenea's clothing/footwear business which followed the electronic /home appliance division electrofun.ro; while three IT retailers have organised online facilities: altex.ro (with an €0.4mln development to boost online sales); e-flamingo; and upshop.ro (by K-Tech). Vlad Stan recently disposed of his successful Vodabet Media business launched in 2000 which expanded into a large online industry involving acasa.ro as well as ele.ro (for women) and smartbuy.ro which compares prices. Total online sales were expected to rise from €0.25mln to €1.0bln during 2008-10 (excluding bill payments) although the recession may now inhibit such growth.

54% of public institutions had Internet access in 2001 rising to 84% in 2003. In 1999 Mangalia took the unusual initiative of installing a video camera (covering 500sq.m) on a pillar beside the town hall, linked to the mangalia.ro website - enabling people to wave at relatives abroad watching on their computer screens! For Romanians without computers there are widespread cyber bar/café facilities, with more specialised facilities such as the 'Internet Shortcut': a salon in Bucharest's Ambassador Hotel (within the capital's 'zero perimeter') with computers connected to world information networks. FX, whose network includes Braşov, Constanţa and Ploieşti has a strategic partnership with Compaq (the prestigious American hardware manufacturer) to make the latter's high speed computers and latest technology available. BB Internet access from fixed points has surged from a symbolic 0.04% of households at the end of 2003 to 4.34% in 2005, 23.02% in 2007 and 30.36 in 2008: a total of 2.51mln connections (Ancom

2009, p.60). However this involves a range of systems by BB providers numbering 599 in 2005 rising to 1094 in 2008 (Ibid, p.54). Meanwhile the total number of BB Internet users reached 1.20mln at the end of 2006 (the increase of 0.73mln during the year giving 150% growth over 2005) including mobile phone users with CDMA/3G technology. Internet access was initially secured through RT phone lines, but cable systems then provided access and now wireless technologies are being more widely used (RT will offer their Click Net service using DSL a new high-speed technology – 30 megabits/sec). The 2.51mln Internet connections quoted by Ancom for 2008 showed a big increase in UTP/FTP cable and satellite (from 0.10 to 1.27mln during 2005-8 while the figures for coaxial cable are 0.25-0.47mln) (Figure 1). It must of course be emphasised that the number of people accessing the Internet is far greater than the figures for Internet connections would suggest. Thus 100,000 official Internet subscriptions in 2000 went along with a penetration figure of 0.7mln (rising to 1.4mln in 2002 and 5.0mln in 2004) arising e-mail accounts linked with the workplace including institutes and universities.

Very significant is the rapid development of neighbourhood cable-based networks (covering an estimated 130,000 subscribers at the end of 2005 but 280,000 six months later according to the regulator Ancom) which arose through the initiative of local entrepreneurs who acquire connections from individuals on the basis of reducing their costs; while the resulting networks are sold on to bigger organisations so that RCS&RDS for example was able to acquire Interlan after the latter had first gained control of 30 small providers including the Bnet, Hi-Fi, RTA and SMN networks in Bucharest.

Meanwhile, Air Bites (Swisscom owned) acquired the Cip Net, Get Net, Link Explore and Net Quest networks in Iași (Business Magazine Review 2009). Such local/housing estate networks of the 'rețea de cartier' type number some 600 nationwide and account for some 0.13mln Internet users (over half in Bucharest). The service providers have been very successful with Evolve Telecom worth €3.0mln (after 700% growth in 2006, with €1.0mln profit) on the basis of its networks in nine towns (attracting 19,000 subscriptions) with three more planned. At the same time the infrastructure requires substantial improvement e.g. to boost the availability of optical fibre cabling in the cities; a matter which is being addressed in Bucharest through a €200mln 'Net City' contract with UTI in 2007 to involve all the

streets in the capital: a system of over 1,400kms due for completion in 2012 (www.net-city.ro); following the initial 12km pilot for B-dul.Unirii and other city-centre streets including Cal.Dudești. Over the country as a whole there is a government programme supported by the present prime minister Emil Boc to expand the network of 'hotspots' for use by computers/laptops equipped with 'Wi-Fi' so as to enjoy free access to the Internet through the wireless system. 95 already exist in hotels, parks, Internet cafes and universities (including 20 in Bucharest, 20 in Brașov and 22 in Cluj, Constanța and Timișoara together) but the intention is to expand the system nationwide to some 350.

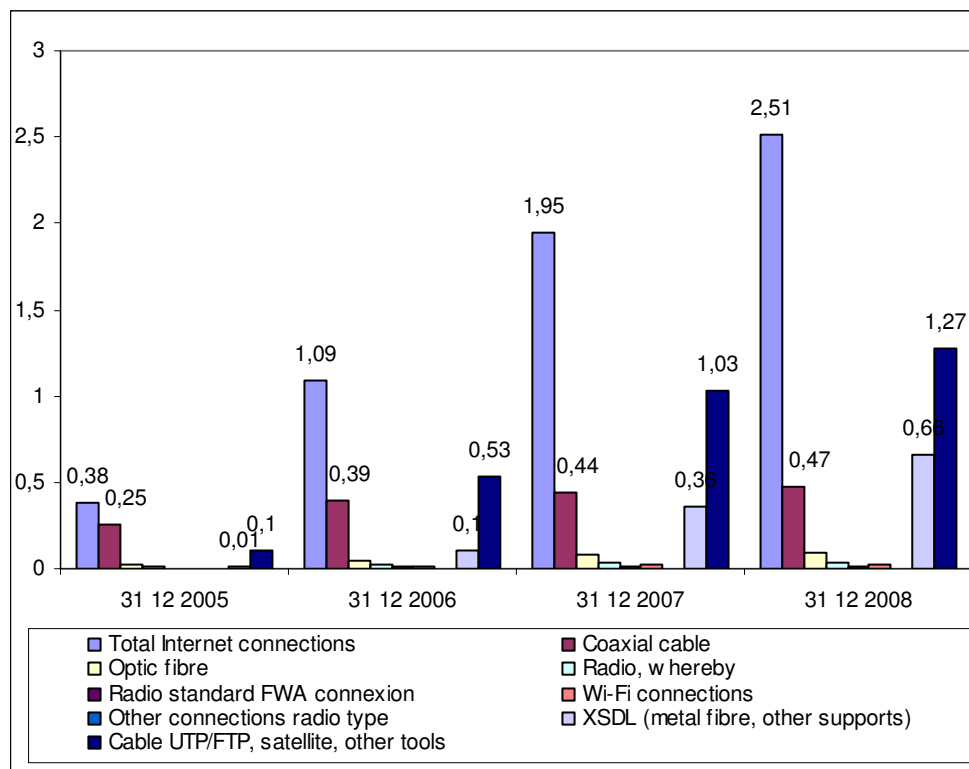


Fig. 1. Internet Connections by the connections' modality (radio, coaxial cable, Wi-Fi, optic fibre, cable UTP/FTP) in BB system (2005-2008)

A New Government Strategy

There has been a great improvement during 2006-8 through falling costs for computer

acquisition (also mobile phones and CATV), a better supply of information and a new class of young people keen to use virtual space. But the

penetration rate is still low by European standards due to late liberalisation of the market (2003), the late launch of DSI (2005) – with implications for the development of electronic services using electric radio frequencies – limited BB coverage and relatively low incomes in rural areas. There are big variations according to age with a third of all teenagers using computers in 2002 and a quarter in the 20–29 age group, but just 4.0% for the 40–59 age group and 1.0% for the over-60s. Also the percentage for males (16) was double that for females. Moreover, the figures were inflated by people surfing the Internet only occasionally, with a roughly 2:1 ratio between regular and occasional users i.e. 16% and 8.0% of the population respectively in 2003 (20% and 10% in 2004). There are also wide variations across Romania. After Bucharest and Ilfov (where fewer than 20% of the population lack such access) there is a large relatively well-favoured group of counties in the 20–40% bracket (Arad, Braşov, Călăraşi, Constanţa, Dolj, Galaţi, Harghita, Hunedoara, Maramureş, Mureş, Sibiu, Timiş and Tulcea) followed by Alba, Bihor, Bistriţa-Năsăud, Caraş-Severin, Dâmboviţa, Ialomiţa, Iaşi, Prahova, Satu Mare, Suceava and Teleorman in the 40–50% group. All the other counties have 50–80% lacking access and clearly merit priority but it is interesting that this includes some relatively well-developed counties like Argeş and Vâlcea (the others are Bacău, Botoşani, Brăila, Buzău, Covasna, Giurgiu, Gorj, Mehedinţi, Neamţ, Olt, Sălaj, Vaslui and Vrancea), where the situation could be affected by the mountainous terrain making it difficult for telecommunications to penetrate all the valleys (although there will always be anomalies arising over investment opportunities; just as the ownership of IT&C equipment will

reflect spending power which may enhanced disproportionately in border counties like Arad and Timiş with relatively easy opportunities to work abroad). However the Boc government is committed to improve access to BB during 2009–15 with increased penetration (particularly in the more backward counties in order to raise the overall national rate to 40% in 2010 and 80% in 2015k while at the same time the public should enjoy better on-line services (including more company websites) and improvements should be made in education and training. There will also be particular attention to small/medium-size enterprises on which the country's economic future depends quite heavily, as well as business and government generally (Government of Romania 2009).

COMPUTER AND SOFTWARE COMPANIES

This market was valued at \$235mln in 2002 with 45% supplied by local system integrators including many original equipment manufacturers while the imports were dominated by such US suppliers as Cisco, Hewlett Packard and IBM. The number of personal computers increased slowly at first but the expansion is now more rapid. From 0.7mln in 2001 the total reached 2.1mln in 2003 subsequently boosted in 2004 by a \$260 subsidy to help students from poor families. In the second quarter of 2005 the computer market rose 50% year on year with the top five: Ktech(UltraPro) 11.7%, Flamingo 11.6% (a remarkable success by a business started in 1995 by three polytechnic students), Altex Davio 11.4% (produced in Bucharest by Complet Electro Serv), RomSoft Computer Warehouse 10.9% and Hewlett Packard – the best placed western manufacturer – with 9.0%.

IT Companies. Much of the equipment required for Romania's IT&C sector is imported. Omnilogic was formed in 1992 to trade in IT&C equipment and established contacts with leading manufacturers including Hewlett Packard, IBM and Dell. It became a leader in the Romanian market with a skilled management team selling through some 800 partners and scoring a turnover of \$120mln in Romania and CEE in 2004. Some foreign firms have their own offices in Romania like SAP (Germany) – selling software licences, including in 2005 basic packages for medium-sized companies. Alcatel have been installing software for rail control systems at Arad, Braşov, Bucharest and Timișoara. They have also contributed to a €1.0mln investment in an R&D centre in Romania for advanced/safe rail control systems and hope for further collaboration with the national railway company SNCFR in future. But there is also a major home-grown software and IT industry employing around 13,000 in 1999 (62% in Bucharest) in 1,200 companies (77% with fewer than 10 employees; 20% with 10–20 and only 2.5% with over 100) building from scratch since 1989.

The market was initially limited because large companies tended to create their own software departments rather than use specialised companies: Romania was contributing only some 2.0% of the West European IT market. However with some 5,000 people producing 5.0% of GNP (90% based on private capital) the potential was considerable. In a situation where most small/medium-sized enterprises had only limited needs at the time and local government was constrained by small budgets for IT, western software companies arrived in the late 1990s to use cheap labour (Turnock 2007, pp.93-126). Several American Internet-related

companies started up in 2000: 'dot.com' companies like ActionWatch, IT firms like Hewlett Packard and Motorola and manufacturing companies like Selectron: the \$10bln electronics firm in Timișoara employing over 2,600 engineers and operators (but owned by Singapore-based Flextronics since 2007). The software market was worth \$104mln in 2002 with local companies supplying a quarter: Romania gained a reputation for security software including anti-spam filters and virus checkers. A good example is the Softwin software and services company, started in 1990 by Florin and Mariuca Talpeș, which employed 700 in 2005 after achieving success with antivirus software since 'Antivirus Expert' AVX was launched in 1996 and distributed internationally from 2000 to compete with Symantec and McAfee. Renamed 'Bitdefender' in 2001, when 70% of its turnover came from exports, the business has now been separated from Softwin and attracts foreign shareholders who have pushed its total value to over \$100mln. It has a presence in Silicon Valley seeking to boost its world market share from two to five per cent. Similar success has been achieved by Ascenta software solutions, Intuitext educational software and Paxato call centre services; while RomSoft of Râmnicu Vâlcea – makers of Oracle software – are doing well with their EU-standard products expected to boost 2007 turnover to €12mln (30 per cent up on 2006). Despite President Băsescu's frank admission that pirated Microsoft software helped Romania build a vibrant technology industry – helping the younger generation discover computing – the company is planning a €13.1mln technical support centre in Bucharest to serve corporate clients in France, Germany and US. This could provide 750 jobs; while Ericsson are

interested in global support centre taking advantage of low taxes

Software Development Companies

These now number some 2,000 in Romania – many exporting to the EU and North America – employing well over 50,000 IT specialists. German companies were prominent by 2001; attracted by a favourable business milieu with low costs and young, skilled labour with extraordinary competence in foreign languages. ADTI is a French company involved in radio communications and systems providing software and expertise for the regulation, modelling, planning and measurement of all networks. But there has also been an American invasion involving Cisco, Compaq, Hewlett Packard, IBM, Oracle and Microsoft, as well as Motorola which has a software development centre in Bucharest for digital signal processors (Turnock 2009, pp,144-9). Exports are helping to drive the growth in IT services and 97% of software/solutions exports in 2003 were performed under outsourcing. With 75% of the business involving EU member states, Romania can offer advantages over Asian countries in geographical and cultural proximity and high quality services. Romania is a rival of India with lower costs and the availability of many people with foreign language skills and good technical training. Indeed, in 2007 Wipro (India's biggest software producer and servicer owned by Azim Premji: India's Bill Gates) established a BPO (Basic Processing/Outsourcing) unit in Bucharest in 2007 employing 150 with the prospect of an increase to 600 by 2010: this location was preferred to Budapest on the basis of language skills and competitive wage levels. A major exporter is Siveco (a leading Romanian integrator

of software applications) which is expanding in Bulgaria (acquiring the well-connected Latona company for €2.0mln) as well as Croatia and Ukraine with the help of \$12mln capital from its shareholders Polish Enterprise Investors and Intel Capital. Some of the leading Romanian firms providing IT solutions and services have been acquired by foreign companies. Forte IT solutions provider was started in 1990 by employees of the Băneasa computer factory and was later acquired by Siemens Business Services for €10mln enabling the latter to become the third leading international player on the domestic market after Hewlett Packard and IBM. And Radix, a Romanian IT solutions/services company which was formed in 1993 and gained custom from high-profile customers including Coca-Cola, Electrica, Hidroelectrică, Mobifon and SNCFR, has been acquired by the global provider Ness (and placed under its Dutch subsidiary Ness Technologies) for €4mln, plus €3.0mln if performance goals are realised over two years; such are the synergies available in the region.

Partnership is another strategy e.g. the rapidly expanding Systems Plus Group (working on distribution and integrated systems for customers such as Auchan, Bancpost, BRD and Rompetrol etc) have a partnership with Hewlett Packard and are also the main Romanian dealer for Dell computers. Development has occurred mainly in Bucharest but some of the American companies already listed have gone to Braşov, Cluj, Iaşi, Oradea and Timișoara as well as Bucharest (IBM have an IT Center in Braşov as part of a global network of 80 such centres; while software developer IP Deval of Bucharest was acquired in 2008 by Enea who are now opening a branch in

Iași). Cluj is to be the base of European operations for the Indian research/analysis company Evalueserve who expect to employ 300 by 2012 in a BPO project extending into a KPO (Knowledge-Process-Outsourcing) operation. Cluj has also been favoured by General Electric's Genpact organisation for business services and technical solutions with BPO established not only in Bucharest in 2005 (employing 650), but also in 2007 in Cluj where several hundred jobs may be created. Great emphasis was placed on a large international airport (hence Braşov and Iași were eliminated) as well as a good business environment, language skills and a supply of university graduates. Other companies like Wipro will almost certainly develop in the provinces eventually to take advantage of lower labour costs.

Conclusion

Romania can now boast a dynamic IT&C sector with the number of companies exceeding 7,300 in 2003, including 400 Internet service providers (in addition to the software development companies already referred to), and a market valued at €800mln in 2004. There is a high degree of concentration in some sectors with the top ten firms in IT services (including Forte, S&T, Siveco and Softwin) responsible for 70% and the situation changing fast with some new entrants moving quickly through the rankings. To assist future growth GECAD Software has launched a high-tech business incubator project to help software firms develop in a business environment - in partnership with venture capital institutions like MCI Management (Poland). The labour force is a major asset: with the advantage of a large pool of highly-skilled labour in engineering and electronics

manufacturing as already noted, Romania claimed some 50,000 specialists in the IT sector in 2002 and the figures nearer 100,000 are now being quoted. The 2002 figure included some 16,100 certified specialists in the IT domain, placing Romania in sixth position in the world after USA, India, Russia, Ukraine and Canada – and ahead of the UK with 15,000. However, a great danger was posed by the lure of more attractive wages in the western countries. In the first years of the new millennium up to 40% of the 5,000 IT graduates produced each year (at a cost of \$60mln) were going abroad, mostly within two years of graduation. A study by International Data Corporation requested by Cisco Systems (world leader in the field of Internet networks) revealed a deficit of 1,500 specialists in 2000 – the weakest link in Romania's Internet development programme – and the education minister made a plea for American IT companies to invest more so that these people could be employed within Romania. There was also a belief that local government could employ many more IT specialists as the budgetary position improves. A survey in 2004 showed that IT employed over 30,000 (earning \$122mln) with 10% annual growth expected.

Labour is still an attraction in terms of cost and quality, but IT salaries have risen very quickly with the rapid growth of recruitment: 13,000 in 2000 to 60,000 end 2008 with the extra burden of rising social security contributions (salaries now account for 60-70% of the budget for software developers). While further foreign investments are mooted, with a possible German assault on Romanian telecoms (e.g. by Deutsche Telekom) there is certainly a slowdown in acquisitions and Siveco (the biggest Romanian software company) up for sale. On the

other hand some companies are still recruiting since French-owned Ubisoft Romania which sells videos and computer games is increasing its workforce in Bucharest and Craiova to 800 while the global PC producer Lenovo (enjoying buoyant sales through most of 2008, especially for laptops) sees growth continuing in a country still catching up on computers and IT expenditure in general, not to mention public sector computerisation. For the moment however the shopping chains are certainly cutting back While RTC Group's Diverta company is investing €100,000 to start an 'Idea' chain selling Apple products, RomSoft's 'Depozitul de Calculatoare' chain slimmed down from 105 shops

in early 2008 but 87 in October 2008 when a further 12 were closed (and four others closed for relocation due to unrealistically high rents) in readiness for a 40% decline in sales (year on year) in the first half of 2009. The company think there is still demand but harsher financial terms mean that new contracts are down 90%. Meanwhile 'Ultra Pro Computers' (K Tech Electronics) have declined from 55 to 43 units during the first quarter of 2009 and 'Twister' (Tornado Systems) lost five of their 35 units in the half-year leading up to March 2009. Hopefully this will not unduly compromise the longer-term trend in what has been a remarkable transformation.

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LIST OF ABBREVIATIONS

Ancom: National Authority for Administration & Regulation in Communication; **BB:** Broad Band (connectivity providing multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing (see DWDM) at a minimum speed of 1.5 megabites/sec; **CDMA:** Code Division Multiple Access (a cellular system using a single frequency band for all the traffic with individual transmissions are differentiated through a unique code before the transmission: note three variants W-CDMA, B-CDMA, TD-SCDMA); **DAMA:** Demand Assignment Multiple Access; **DECT:** Digital Enhanced Cordless Telecommunications; **DSL:** Digital Subscriber Line (equipment transforming standard telephone lines into high-speed data communications links: see ADSL, HDSL, SDSL, VDSL, and XDSL); **DTH:** Direct to Home; **EDGE:** Enhanced Data Rates for Global Environment (tripling the capacity of GPRS technology to allow high speed use of Internet mobile services and provide wider coverage using existing infrastructure); **FTP:** File Transfer Protocol/Foiled Twisted Pair (a standard Internet protocol, is the simplest way to exchange files between computers on the Internet and FTP is commonly used to transfer Web page files from their creator to the computer; acting as the server for everyone on the Internet); **GPRS:** Global Position Radio Services (based on data transmission with mobile Internet access and other communication at speeds up to 115 kilobites/sec); **GSM:** Global System of Mobile Communications (one of the most developed technologies of digital mobile phones predominant worldwide based on modulation TDMA – see below – allowing eight simultaneous calls on the same radio frequency); **ISDN:** Integrated Services Digital Network (providing different communication packages offering a digital connection between user/network interfaces); **ISP:** Internet Service Provider (offers access to the network servers (electronic mail, news, Web), routers and modems connected permanently at Internet nodes with high speed); **IT:** Information Technology; **NGN:** Next Generation Network; **OTE:** Greek Telecom; **RT:** Romtelecom; **SIM:** Subscriber Identity Module (a smart card with a subscriber's phone number, coded identity details, PIN and other data); **TC:** Telecommunications; **TDMA:** Time Division Multiple Access (a technology for digital transmission by radio signal); **TIW:** Telesystem International Wireless (a Canadian group global mobile communication operator); **UMTS:** Universal Mobile TC System (for data transfer of 384 kilobites/sec with transmission of video images or telephone video images on a mobile phone colour screen); **VoIP:** Voice Over Internet Protocol (offering connections to vocal calls through computers networks); **W-CDMA:** Wideband: Code Division Multiple Access (radio technology of high speed/capacity – up to two megabites/sec – generating a new media application by use of mobile phones covering colour graphics, TV, audio digital registration, Internet and e-mail); **Wi-Fi:** Wireless Fidelity (a licenced brand of the Wi-Fi Alliance Group involving technology based on network wireless (WLAN); **WLL:** Wireless Local Loop (a technology offering telephony services and data of low speed for clients using the wireless services); **3G:** Third Generation; **UTP:** Unshielded Twisted Pair; **XDSL:** a generic term used to refer to the entire family of DSL technologies: 'X' acts a placeholder for the initial letters of ADSL, HDSL, SDSL and VDSL.