**manajemen biaya proyek**

Juan Gonzales adalah analis sistem dan spesialis jaringan untuk departemen pengairan di kota besar Meksiko. Dia senang membantu kota mengembangkan infrastrukturnya. Tujuan kariernya berikutnya adalah menjadi manajer proyek sehingga ia dapat memiliki pengaruh lebih besar lagi. Salah satu rekannya mengundangnya untuk menghadiri pertemuan peninjauan proyek penting untuk proyek-proyek pemerintah besar, termasuk proyek Pro Surveyor, di mana Juan paling tertarik. Proyek Surveyor Pro adalah konsep untuk mengembangkan sistem informasi canggih yang mencakup sistem pakar, database berorientasi objek, dan komunikasi nirkabel. Sistem akan memberikan informasi instan dan grafis untuk membantu surveyor pemerintah melakukan pekerjaan mereka. Misalnya, setelah surveyor menyentuh peta pada layar perangkat genggam, sistem akan meminta surveyor memasukkan jenis informasi yang diperlukan untuk area itu. Sistem ini akan membantu dalam perencanaan dan implementasi banyak proyek, mulai dari memasang kabel serat optik hingga memasang saluran air. Namun, Juan sangat terkejut bahwa mayoritas pertemuan dihabiskan untuk membahas masalah yang berkaitan dengan biaya. Pejabat pemerintah sedang meninjau banyak proyek yang ada untuk mengevaluasi kinerja mereka dan dampak potensial pada anggaran mereka sebelum membahas pendanaan untuk proyek baru. Juan tidak mengerti banyak syarat dan grafik yang disajikan. Apa "nilai yang diperoleh" yang terus mereka rujuk? Bagaimana mereka memperkirakan berapa biayanya untuk menyelesaikan proyek atau berapa lama? Juan berpikir dia akan belajar lebih banyak tentang teknologi baru yang akan digunakan proyek Surveyor Pro, tetapi dia menemukan bahwa perkiraan biaya dan manfaat yang diproyeksikan adalah yang paling menarik bagi pejabat pemerintah pada pertemuan tersebut. Tampaknya juga upaya yang cukup besar akan dilakukan untuk studi keuangan terperinci sebelum pekerjaan teknis apa pun bisa dimulai. Juan berharap dia telah mengambil beberapa mata kuliah akuntansi dan keuangan sehingga dia dapat memahami akronim dan konsep yang sedang didiskusikan orang. Meskipun Juan memiliki gelar di bidang teknik listrik, ia tidak memiliki pendidikan formal di bidang keuangan dan sedikit pengalaman dengan itu. Namun, jika Juan dapat memahami sistem dan jaringan informasi, ia yakin bahwa ia dapat memahami masalah keuangan pada proyek juga. Dia mencatat pertanyaan untuk didiskusikan dengan rekan-rekannya setelah pertemuan.

**PENTINGNYA MANAJEMEN BIAYA PROYEK**

Proyek TI memiliki rekam jejak yang buruk dalam memenuhi tujuan anggaran. Studi CHAOS dari Standish Group melaporkan kelebihan biaya rata-rata — persentase tambahan atau jumlah dolar di mana biaya aktual melebihi perkiraan — untuk proyek-proyek TI yang tidak berhasil yang berkisar antara 180 persen pada 1994 hingga 43 persen pada 2010. Meskipun para peneliti akademis mempertanyakan validitas angka-angka ini , lebih teliti, studi yang ditinjau secara ilmiah mengakui masalah kelebihan biaya untuk proyek-proyek TI. Sebagai contoh, tiga survei terpisah mengenai kelebihan biaya proyek perangkat lunak oleh Jenkins, Phan, dan Bergeron, masing-masing pada tahun 1984, 1988, dan 1992, menemukan bahwa rata-rata biaya yang melebihi untuk semua proyek dalam sampel survei mereka (bukan hanya proyek yang tidak berhasil) adalah 33–34 persen.1

Sebuah studi 2011 yang diterbitkan di Harvard Business Review meneliti inisiatif perubahan IT di hampir 1.500 proyek dan melaporkan biaya rata-rata yang melebihi 27 persen. Studi ini dianggap sebagai yang terbesar untuk menganalisis proyek-proyek TI. Proyek-proyek tersebut berkisar dari perencanaan sumber daya perusahaan hingga informasi manajemen dan sistem manajemen hubungan pelanggan. Sebagian besar proyek mengeluarkan biaya tinggi, dengan biaya rata-rata $ 167 juta; proyek terbesar menelan biaya $ 33 miliar. Temuan paling penting dalam penelitian ini, bagaimanapun, adalah penemuan sejumlah besar kelebihan penggunaan raksasa ketika menganalisis data overrun proyek. Satu dari enam dari semua proyek yang diteliti mengandung "angsa hitam": peristiwa berdampak tinggi yang jarang terjadi dan tidak dapat diprediksi, tetapi tidak mustahil dalam retrospeksi. Proyek angsa hitam TI ini memiliki rata-rata biaya overrun 200 persen dan jadwal overrun hampir 70 persen. "Ini menyoroti jebakan sebenarnya dari inisiatif perubahan TI: Bukannya mereka cenderung rentan terhadap kelebihan biaya rata-rata, seperti yang disarankan oleh konsultan manajemen dan studi akademis sebelumnya. Sebagian besar dari mereka mengalami kelebihan penggunaan yang sangat besar — ​​yaitu, ada angsa hitam yang jumlahnya tidak proporsional. Dengan berfokus pada rata-rata alih-alih outlier yang lebih merusak, sebagian besar manajer dan konsultan kehilangan masalah sebenarnya. ”2

Jelas, proyek-proyek TI memiliki ruang untuk perbaikan dalam memenuhi sasaran biaya. Bab ini menjelaskan konsep-konsep penting dalam manajemen biaya proyek, khususnya perencanaan manajemen biaya, membuat perkiraan yang baik, dan menggunakan manajemen nilai yang diperoleh (EVM) untuk membantu dalam pengendalian biaya.

**Apa yang salah?**

Tidak ada kekurangan contoh proyek TI yang menderita dari manajemen biaya yang buruk. Internal Revenue Service (IRS) AS dan lembaga pemerintah lainnya terus memberikan contoh bagaimana tidak mengelola biaya.

• IRS mengelola serangkaian kegagalan proyek pada 1990-an yang membebani pembayar pajak lebih dari $ 50 miliar per tahun — kira-kira uang sebanyak laba bersih tahunan dari seluruh industri komputer pada tahun-tahun itu.3

• Pada 2006, IRS kembali berada di berita untuk pembaruan yang gagal ke perangkat lunaknya yang cacat. IRS berencana untuk meluncurkan sistem pada bulan Januari, tepat pada musim pajak 2006 dan satu tahun setelah tanggal implementasi awal, tetapi itu tidak terjadi. Pemerintah AS memperkirakan bahwa kurangnya sistem anti-penipuan yang berfungsi menelan biaya $ 318 juta dalam pengembalian uang palsu yang tidak tertangkap.4

• Laporan Kantor Akuntabilitas Pemerintah (GAO) 2008 menyatakan bahwa lebih dari 400 proyek TI lembaga pemerintah AS bernilai diperkirakan $ 25 miliar, menderita karena perencanaan yang buruk dan kinerja yang buruk. Senator AS Tom Carper dari Delaware mengatakan proyek-proyek TI itu berlebihan, tidak memiliki tujuan yang jelas, dan dikelola oleh orang-orang yang tidak memenuhi syarat.5

Contoh lain yang menunjukkan tantangan dalam mengelola biaya proyek adalah program modernisasi TI National Health Service (NHS) Inggris. Disebut "bencana TI terbesar dalam sejarah" oleh seorang kolumnis London, program 10 tahun ini, yang dimulai pada tahun 2002, diciptakan untuk menyediakan sistem catatan pasien elektronik, pemesanan janji temu, dan sistem obat resep di Inggris dan Wales. Pemerintah Partai Buruh Inggris memperkirakan bahwa program tersebut pada akhirnya akan menelan biaya lebih dari $ 55 miliar, $ 26 miliar yang dikuasai. Program ini telah diganggu oleh masalah teknis karena sistem yang tidak kompatibel, penolakan dari dokter yang mengatakan mereka tidak cukup diajak berkonsultasi tentang fitur sistem, dan argumen di antara kontraktor tentang siapa yang bertanggung jawab untuk apa.6 Audit pemerintah pada Juni 2006 menemukan bahwa program tersebut, salah satu proyek TI sipil terbesar yang dilakukan di seluruh dunia, mengalami kemajuan meskipun memiliki masalah profil tinggi. Dalam upaya mengurangi

berjalan, program NHS tidak akan lagi membayar produk sampai pengiriman, menggeser beberapa

tanggung jawab finansial kepada kontraktor utama, termasuk Grup BT, Accenture, dan Fujitsu

Layanan.7 Pada 22 September 2011, pejabat pemerintah di Britania Raya mengumumkan

bahwa mereka membatalkan Program Nasional untuk Kesehatan IT. Sekretaris Kesehatan Andrew

Lansley mengatakan bahwa program tersebut "mengecewakan NHS dan membuang-buang uang pembayar pajak." 8

Berapa Biayanya?

Buku teks akuntansi biaya populer menyatakan, “Akuntan biasanya mendefinisikan biaya sebagai sumber daya dikorbankan atau hilang untuk mencapai tujuan tertentu. ”9 Kamus Webster mendefinisikan biaya sebagai

"Sesuatu yang diserahkan sebagai imbalan." Biaya sering diukur dalam jumlah moneter, misalnya sebagai dolar, itu harus dibayar untuk mendapatkan barang dan jasa. (Untuk kenyamanan, ujian-ples dalam bab ini menggunakan dolar untuk jumlah uang.) Karena proyek membutuhkan biaya dan mengkonsumsi sumber daya yang dapat digunakan di tempat lain, sangat penting bagi manajer proyek untuk memahami manajemen biaya proyek.

Namun, banyak profesional TI sering bereaksi terhadap biaya informasi yang dibanjiri dengan seringai.

Mereka tahu bahwa banyak dari perkiraan biaya awal untuk proyek-proyek TI rendah atau berdasarkan persyaratan proyek tidak jelas, jadi tentu saja akan ada kelebihan biaya. Tidak menekankan pentingnya perkiraan biaya proyek yang realistis sejak awal hanya merupakan satu bagian saja masalah. Selain itu, banyak profesional TI berpikir bahwa menyiapkan perkiraan biaya adalah pekerjaan akuntan. Sebaliknya, menyiapkan perkiraan biaya yang baik adalah tuntutan, penting keterampilan yang dibutuhkan banyak profesional.

Alasan lain yang dirasakan untuk pembengkakan biaya adalah bahwa banyak proyek TI melibatkan yang baru teknologi atau proses bisnis. Segala teknologi baru atau proses bisnis tidak teruji dan memiliki risiko yang melekat. Jadi, biaya tumbuh dan kegagalan diharapkan, kan? Salah. Menggunakan manajemen biaya proyek yang baik dapat mengubah persepsi salah ini.

Apa biaya proyek manajemen?

Ingat dari Bab 1 bahwa kendala rangkap tiga dari manajemen proyek melibatkan keseimbangan ruang lingkup, waktu, dan sasaran biaya. Bab 5 dan 6 membahas ruang lingkup proyek dan manajemen waktu, dan bab ini menjelaskan manajemen biaya proyek. Manajemen biaya proyek termasuk proses yang diperlukan untuk memastikan bahwa tim proyek menyelesaikan proyek dalam suatu anggaran yang disetujui. Perhatikan dua frasa penting dalam definisi ini: "sebuah proyek" dan "disetujui anggaran. ”Manajer proyek harus memastikan proyek mereka didefinisikan dengan baik, akurat perkiraan waktu dan biaya, dan memiliki anggaran realistis yang mereka terlibat dalam menyetujui.

Adalah tugas manajer proyek untuk memuaskan pemangku kepentingan proyek sambil terus berupaya mengurangi dan mengendalikan biaya. Ada empat proses untuk manajemen biaya proyek:

1. Perencanaan manajemen biaya melibatkan penentuan kebijakan, prosedur, dan dokumentasi yang akan digunakan untuk perencanaan, pelaksanaan, dan pengendalian biaya proyek. Output utama dari proses ini adalah rencana manajemen biaya.
2. Estimasi biaya melibatkan pengembangan perkiraan atau estimasi biaya sumber daya yang dibutuhkan untuk menyelesaikan suatu proyek. Output utama dari proses estimasi biaya adalah estimasi biaya aktivitas, dasar estimasi, dan pembaruan dokumen proyek.
3. Menentukan anggaran melibatkan pengalokasian estimasi biaya keseluruhan untuk benda kerja tunggal untuk menetapkan garis dasar untuk mengukur kinerja. Itu keluaran utama dari proses penganggaran biaya adalah baseline biaya, proyek persyaratan pendanaan, dan pembaruan dokumen proyek.
4. Mengontrol biaya melibatkan mengendalikan perubahan pada anggaran proyek. Itu output utama dari proses pengendalian biaya adalah informasi kinerja kerja, perkiraan biaya, permintaan perubahan, pembaruan rencana manajemen proyek, proyek pembaruan dokumen, dan pembaruan aset proses organisasi.

Untuk memahami setiap proses manajemen biaya proyek, Anda harus terlebih dahulu memahami berdiri prinsip-prinsip dasar manajemen biaya. Banyak dari prinsip-prinsip ini tidak unik manajemen proyek; namun, manajer proyek perlu memahami bagaimana prinsip-prinsip ini berhubungan dengan proyek spesifik mereka.

PRINSIP DASAR MANAJEMEN BIAYA

Banyak proyek TI tidak pernah dimulai karena profesional TI tidak memahami pentingnya prinsip akuntansi dan keuangan dasar. Konsep penting seperti analisis nilai sekarang bersih, laba atas investasi, dan analisis pengembalian dibahas dalam Bab 4, Manajemen Integrasi Proyek. Demikian juga banyak proyek yang dimulai tidak pernah selesai karena masalah manajemen biaya. Sebagian besar anggota eksekutif dewan memiliki pemahaman yang lebih baik tentang persyaratan keuangan daripada persyaratan TI, dan lebih dari itu tertarik pada keuangan. Oleh karena itu, manajer proyek TI harus dapat menyajikan dan mendiskusikan informasi proyek baik dari segi keuangan dan teknis. Selain analisis nilai sekarang bersih, pengembalian investasi, dan analisis pengembalian, manajemen proyek

Agers harus memahami beberapa prinsip, konsep, dan ketentuan manajemen biaya lainnya.

Bagian ini menjelaskan topik umum seperti keuntungan, biaya siklus hidup, analisis arus kas, biaya dan manfaat berwujud dan tidak berwujud, biaya langsung, biaya hangus, teori kurva belajar, dan cadangan. Topik penting lainnya — manajemen nilai yang diperoleh — adalah salah satunya alat dan teknik utama untuk mengendalikan biaya proyek; dijelaskan secara rinci dalam bagian tentang pengendalian biaya.

Keuntungan adalah pendapatan dikurangi pengeluaran. Untuk meningkatkan laba, perusahaan dapat meningkatkan pendapatan, mengurangi biaya, atau mencoba melakukan keduanya. Sebagian besar eksekutif lebih diperhatikan dengan keuntungan dibandingkan dengan masalah lain. Ketika membenarkan investasi dalam informasi baru Dengan sistem dan teknologi, penting untuk fokus pada dampak pada laba, bukan hanya pendapatan atau pengeluaran. Pertimbangkan aplikasi e-commerce yang Anda perkirakan akan meningkatkan pendapatan untuk perusahaan $ 100 juta sebesar 10 persen. Anda tidak dapat mengukur potensi manfaat aplikasi tanpa mengetahui margin keuntungan. Margin laba adalah rasio pendapatan terhadap laba. Jika pendapatan $ 100 menghasilkan laba $ 2, ada margin laba 2 persen. Jika perusahaan kehilangan $ 2 untuk setiap $ 100 dalam pendapatan, ada margin keuntungan 2 persen.

Biaya siklus hidup memungkinkan Anda melihat gambaran besar biaya proyek sepanjang siklus hidupnya. Ini membantu Anda mengembangkan proyeksi akurat suatu proyek biaya dan manfaat finansial. Biaya siklus hidup mempertimbangkan total biaya kepemilikan, atau pengembangan ditambah biaya dukungan, untuk suatu proyek. Misalnya, perusahaan mungkin selesai proyek untuk mengembangkan dan menerapkan sistem layanan pelanggan baru dalam satu atau dua tahun, tetapi sistem baru bisa diterapkan selama 10 tahun. Manajer proyek, dengan bantuan dari pakar keuangan di organisasinya, harus membuat perkiraan biaya dan manfaat proyek untuk seluruh siklus hidupnya (10 tahun dalam contoh sebelumnya). Ingat dari Bab 4 bahwa analisis nilai sekarang bersih untuk proyek akan dilakukan termasuk seluruh biaya dan manfaat selama 10 tahun. Manajemen dan proyek puncak manajer perlu mempertimbangkan biaya siklus hidup proyek ketika mereka menghasilkan uang keputusan.

Organisasi memiliki sejarah tidak menghabiskan cukup uang pada fase awal Proyek TI, yang memengaruhi total biaya kepemilikan. Misalnya, jauh lebih mahal efektif untuk mengeluarkan uang untuk mendefinisikan kebutuhan pengguna dan melakukan pengujian awal TI memproyeksikan daripada menunggu masalah muncul setelah implementasi. Ingat dari Bab 5 bahwa memperbaiki cacat perangkat lunak pada suatu proyek dapat menghabiskan biaya 100 kali lipat daripada memperbaiki cacat lebih awal.

Karena organisasi bergantung pada IT yang andal, biaya besar terkait dengan penurunan waktu. Misalnya, Tabel 7-1 merangkum biaya rata-rata satu menit waktu henti untuk aplikasi TI yang berbeda. Biaya termasuk biaya untuk mengembalikan sistem, biaya staf menebus kehilangan pekerjaan dalam produksi selama downtime sistem, dan mengarahkan dan kehilangan pendapatan tidak langsung.

APA YANG BENAR?

Banyak organisasi menggunakan IT untuk mengurangi biaya operasional. Misalnya, penelitian tahun 2008 menunjukkan bahwa teknologi telah menurunkan biaya (disesuaikan dengan inflasi) yang terkait dengan memproses transaksi ATM dari lembaga keuangan:

• Pada tahun 1968, biaya rata-rata adalah $ 5.

• Pada tahun 1978, biayanya turun menjadi $ 1,50.

• Pada tahun 1988, biayanya hanya nikel.

• Pada tahun 1998, harganya hanya satu sen.

• Pada 2008, biayanya hanya setengah sen! 11

Strategi pemotongan biaya lainnya terinspirasi oleh penekanan global pada peningkatan lingkungan. Berinvestasi dalam IT hijau dan inisiatif lain telah membantu baik lingkungan garis bawah pemerintah dan perusahaan. Michael Dell, CEO Dell, mengatakan dia bermaksud membuatnya "karbon netral" perusahaan pada tahun 2008. "Raksasa komputer sedang mencari cara untuk menghilangkan karbonnya emisi melalui sejumlah inisiatif, seperti menawarkan usaha kecil dan konsumen meramaikan daur ulang komputer lama mereka, mengisi tas daur ulang kecil dengan gratis mengirim ongkos kirim ke kotak-kotak kartrid tinta-printer baru, dan mengoperasikan ‘Tanam Pohon untukku’ program. ”12 Dell berhasil mencapai tujuannya; pada Maret 2012, Dell telah membantu pelanggannya menabung hampir $ 7 miliar dalam biaya energi. Kunjungi www.dell.com/earth untuk informasi lebih lanjut.

Analisis arus kas adalah metode untuk menentukan estimasi biaya tahunan dan manfaat cocok untuk proyek dan arus kas tahunan yang dihasilkan. Manajer proyek harus melakukan uang tunai analisis aliran untuk menentukan nilai sekarang bersih. Sebagian besar konsumen memahami konsep dasar kecuali arus kas: Jika mereka tidak memiliki cukup uang di dompet atau rekening bank mereka, mereka tidak dapat membeli sesuatu. Manajemen puncak harus mempertimbangkan masalah arus kas ketika memilih proyek untuk berinvestasi. Jika manajemen puncak memilih terlalu banyak proyek yang memiliki kebutuhan arus kas yang tinggi di tahun yang sama, perusahaan tidak akan dapat mendukung semua proyeknya dan mempertahankan profitabilitasnya. Penting juga untuk memperjelas tahun yang digunakan untuk menganalisis jumlah dolar. Misalnya, jika perusahaan mendasarkan semua biaya pada perkiraan 2012, itu perlu memperhitungkan inflasi dan faktor lain ketika memproyeksikan biaya dan manfaat dalam dolar tahun depan.

Biaya dan manfaat berwujud dan tidak berwujud adalah kategori untuk menentukan seberapa baik suatu organisasi dapat menentukan perkiraan biaya dan manfaat untuk suatu proyek. Biaya nyata atau manfaat dapat dengan mudah diukur dalam dolar. Sebagai contoh, anggaplah bahwa proyek Pro Surveyor yang dijelaskan dalam kasus pembukaan bab termasuk studi kelayakan awal. Jika sebuah perusahaan menyelesaikan studi ini untuk $ 100.000, biaya nyata adalah $ 100.000. Jika suatu Badan tersebut memperkirakan bahwa pihaknya dapat melakukan penelitian itu sendiri sebesar $ 150.000, manfaat nyata dari penelitian ini adalah $ 50.000 kepada pemerintah: Itu dapat membayar perusahaan Juan untuk studi dan kemudian menugaskan pekerja pemerintah yang akan melakukan studi ke proyek lain. Sebaliknya, biaya atau manfaat tidak berwujud sulit diukur dalam mone-istilah tary. Misalkan Juan dan beberapa orang lainnya menghabiskan waktu pribadi mereka menggunakan komputer, buku, dan sumber daya milik pemerintah untuk meneliti area yang berkaitan dengan belajar. Meskipun jam kerja mereka dan barang-barang milik pemerintah tidak akan ditagih proyek, mereka dapat dianggap biaya tidak berwujud. Manfaat tidak berwujud untuk proyek sering kali mencakup item-item seperti itikad baik, prestise, dan pernyataan umum tentang peningkatan produktivitas. bahwa suatu organisasi tidak dapat dengan mudah menerjemahkan ke dalam jumlah dolar. Karena biaya dan manfaat tidak berwujud sulit diukur, mereka seringkali lebih sulit untuk dibenarkan.

Biaya langsung dapat secara langsung terkait dengan menciptakan produk dan layanan proyek. Anda dapat mengaitkan biaya langsung ke proyek tertentu. Sebagai contoh, biaya langsung termasuk gaji orang yang bekerja penuh waktu di proyek dan biaya perangkat keras dan perangkat lunak yang dibeli khusus untuk proyek. Manajer proyek harus fokus pada biaya langsung karena mereka dapat dikendalikan.

Biaya tidak langsung tidak terkait langsung dengan produk atau layanan proyek, tetapi secara tidak langsung terkait dengan melakukan proyek. Misalnya, biaya tidak langsung akan termasuk biaya listrik, handuk kertas, dan kebutuhan lainnya di gedung besar yang menampung 1.000 karyawan yang bekerja di banyak proyek. Biaya tidak langsung dialokasikan untuk proyek, dan manajer proyek memiliki sangat sedikit kendali atas mereka.

Sunk cost adalah uang yang telah dihabiskan di masa lalu. Anggap saja hilang, seperti kapal karam yang tidak pernah bisa dinaikkan. Saat memutuskan proyek untuk berinvestasi atau melanjutkan, Anda seharusnya tidak termasuk biaya hangus. Sebagai contoh, dalam kasus pembukaan bab, anggaplah bahwa kantor Juan telah menghabiskan $ 1 juta untuk sebuah proyek selama tiga tahun terakhir untuk membuat geosistem informasi grafis, tetapi tidak pernah menghasilkan sesuatu yang berharga. Jika pemerintahnya sedang mengevaluasi proyek apa yang akan didanai tahun depan dan seorang pejabat menyarankan untuk melanjutkan mendanai proyek sistem informasi geografis karena $ 1 juta telah dihabiskan untuk itu sudah, pejabat salah akan membuat biaya hangus faktor kunci dalam proyek keputusan seleksi. Banyak orang jatuh ke dalam perangkap untuk terus menghabiskan uang untuk proyek yang gagal karena sudah begitu banyak uang yang dihabiskan untuk itu. Perangkap ini mirip dengan gamblers yang terus bertaruh karena mereka sudah kehilangan uang. Biaya sunk harus dilupakan, meskipun seringkali sulit untuk berpikir seperti itu.

Teori kurva belajar menyatakan bahwa ketika banyak item diproduksi berulang kali, the biaya satuan dari barang-barang itu berkurang dalam pola reguler karena lebih banyak unit diproduksi. Untuk Misalnya, anggap proyek Pro Surveyor berpotensi menghasilkan 1.000 perangkat genggam perangkat yang dapat menjalankan perangkat lunak baru dan mengakses informasi melalui satelit. Biaya dari unit genggam pertama akan jauh lebih tinggi daripada biaya unit keseribu. Teori kurva belajar harus membantu memperkirakan biaya pada proyek yang melibatkan produksi jumlah besar barang. Teori kurva belajar juga berlaku untuk jumlah waktu diperlukan untuk menyelesaikan beberapa tugas. Misalnya, pertama kali seorang karyawan baru melakukan sebuah tugas khusus, mungkin akan memakan waktu lebih lama dari kesepuluh kali karyawan melakukan sebuah tugas yang sangat mirip.

Cadangan adalah jumlah dolar yang dimasukkan dalam perkiraan biaya untuk mengurangi risiko biaya dengan memungkinkan situasi di masa depan yang sulit diprediksi. Cadangan kontingensi memungkinkan untuk situasi masa depan yang mungkin sebagian direncanakan untuk (kadang-kadang disebut tidak dikenal dikenal) dan termasuk dalam baseline biaya proyek. Misalnya, jika suatu organisasi tahu itu tingkat turnover 20 persen untuk personel TI, itu harus mencakup cadangan kontingensi untuk membayar biaya perekrutan dan pelatihan personil TI. Cadangan manajemen memungkinkan untuk situasi di masa depan yang tidak dapat diprediksi (kadang-kadang disebut tidak dikenal tidak dikenal). Sebagai contoh, jika manajer proyek sakit selama dua minggu atau pemasok penting keluar dari bisnis, cadangan manajemen dapat disisihkan untuk menutupi biaya yang dihasilkan. Cadangan manajemen tidak termasuk dalam baseline biaya, karena Anda akan belajar nanti dalam bab ini.

MANAJEMEN BIAYA PERENCANAAN

Langkah pertama dalam manajemen biaya proyek adalah merencanakan bagaimana biaya akan dikelola sepanjang kehidupan proyek. Biaya proyek, seperti jadwal proyek, tumbuh dari dokumen dasar yang memulai proyek, seperti piagam proyek. Manajer proyek dan pemangku kepentingan lain menggunakan penilaian ahli, teknik analisis, dan pertemuan untuk menghasilkan rencana manajemen biaya.

Rencana manajemen biaya, seperti ruang lingkup dan jadwal rencana manajemen, dapat

informal dan luas atau formal dan terperinci, berdasarkan kebutuhan proyek. Secara umum,

rencana manajemen biaya mencakup informasi berikut:

• Tingkat akurasi: Estimasi biaya kegiatan biasanya memiliki pedoman pembulatan,

seperti pembulatan ke $ 100 terdekat. Mungkin juga ada pedoman untuk

jumlah dana kontingensi untuk dimasukkan, seperti 10 atau 20 persen.

• Satuan ukuran: Setiap unit digunakan dalam pengukuran biaya, seperti jam kerja

atau hari, harus ditentukan.

• Tautan prosedur organisasi: Banyak organisasi merujuk pada pekerjaan

komponen struktur kerusakan (WBS) yang digunakan untuk akuntansi biaya proyek sebagai

akun kontrol (CA). Setiap akun kontrol sering diberi unik

kode yang digunakan dalam sistem akuntansi organisasi. Tim proyek harus

pahami dan gunakan kode-kode ini dengan benar.

• Ambang kontrol: Mirip dengan penjadwalan varian, biaya sering kali ditentukan

jumlah variasi yang diizinkan sebelum tindakan perlu diambil, seperti 10

persen dari biaya dasar.

• Aturan pengukuran kinerja: Jika proyek menggunakan manajemen nilai yang diperoleh

ment (EVM), sebagaimana dijelaskan nanti dalam bab ini, rencana manajemen biaya

akan menentukan aturan pengukuran, seperti seberapa sering biaya aktual akan terjadi

dilacak dan ke tingkat detail apa.

• Format pelaporan: Bagian ini akan menjelaskan format dan frekuensi

laporan biaya yang diperlukan untuk proyek tersebut.

• Deskripsi proses: Rencana manajemen biaya juga akan menjelaskan caranya

melakukan semua proses manajemen biaya.

ESTIMASI BIAYA

Manajer proyek harus menganggap serius perkiraan biaya jika ingin menyelesaikan proyek

dalam batasan anggaran. Setelah mengembangkan daftar persyaratan sumber daya yang baik, proyek

manajer dan tim proyek mereka harus mengembangkan beberapa perkiraan biaya untuk sumber daya ini. Ingat dari Bab 6 bahwa proses penting dalam manajemen waktu proyek adalah memperkirakan sumber daya aktivitas, yang menyediakan daftar persyaratan sumber daya aktivitas. Misalnya, jika suatu kegiatan untuk suatu proyek adalah melakukan jenis tertentu

tes, daftar persyaratan sumber daya kegiatan akan menggambarkan tingkat keterampilan orang yang diperlukan untuk melakukan tes, jumlah orang dan jam yang disarankan untuk

melakukan pengujian, kebutuhan akan perangkat lunak atau peralatan khusus, dan persyaratan lainnya.

Semua informasi ini diperlukan untuk mengembangkan perkiraan biaya yang baik. Bagian ini

menjelaskan berbagai jenis estimasi biaya, alat dan teknik untuk memperkirakan biaya,

masalah khas yang terkait dengan perkiraan biaya TI, dan contoh terperinci dari biaya

estimasi untuk proyek TI.

Jenis Perkiraan Biaya

Salah satu output utama dari manajemen biaya proyek adalah perkiraan biaya. Manajer proyek

biasanya menyiapkan beberapa jenis perkiraan biaya untuk sebagian besar proyek. Tiga tipe dasar estimasi meliputi:

• Estimasi kasar urutan besarnya (ROM) memberikan perkiraan berapa biaya proyek. Estimasi ROM juga bisa disebut sebagai perkiraan rata-rata pasangan, perkiraan angka, barang curian, atau ukuran luas. Jenis perkiraan ini dilakukan sangat awal dalam suatu proyek atau bahkan sebelum proyek secara resmi dimulai. Manajer proyek dan manajemen puncak menggunakan estimasi ini untuk membantu membuat proyek terpilih keputusan tion. Kerangka waktu untuk jenis estimasi ini seringkali tiga tahun atau lebih sebelum penyelesaian proyek. Keakuratan perkiraan ROM biasanya biasanya 50 persen hingga percent100 persen, artinya biaya aktual proyek bisa 50 persen di bawah perkiraan ROM atau 100 persen di atas. Sebagai contoh, biaya aktual untuk proyek dengan perkiraan ROM $ 100.000 dapat berkisar dari $ 50.000 hingga $ 200.000. Untuk perkiraan proyek TI, kisaran akurasi ini adalah seringkali jauh lebih luas. Banyak profesional TI secara otomatis menggandakan perkiraan untuk pengembangan perangkat lunak karena sejarah kelebihan biaya pada proyek TI.

Perkiraan anggaran digunakan untuk mengalokasikan uang ke dalam anggaran organisasi. Banyak organisasi mengembangkan anggaran setidaknya dua tahun ke depan. Perkiraan anggaran dibuat satu atau dua tahun sebelum penyelesaian proyek. Keakuratan estimasi anggaran biasanya 10 persen hingga þ25 persen, artinya biaya aktual bisa 10 persen lebih sedikit atau 25 persen lebih dari perkiraan anggaran. Misalnya, biaya aktual untuk proyek dengan anggaran perkiraan getary $ 100,000 dapat berkisar dari $ 90.000 hingga $ 125.000.

• Estimasi definitif memberikan estimasi biaya proyek yang akurat. Definisi estimasi tive digunakan untuk membuat banyak keputusan pembelian yang estimasi akurat diperlukan dan untuk memperkirakan biaya proyek akhir. Misalnya, jika suatu proyek melibatkan pembelian 1.000 komputer pribadi dari pemasok luar dalam tiga bulan ke depan, perkiraan pasti akan Jumlah dan jenis perkiraan biaya bervariasi berdasarkan area aplikasi. Misalnya,

Asosiasi untuk Kemajuan Rekayasa Biaya (AACE) Internasional mengidentifikasi lima jenis perkiraan biaya untuk proyek-proyek konstruksi: urutan besarnya, konseptual, pendahuluan, pasti, dan kontrol. Poin utamanya adalah bahwa estimasi biasanya dilakukan pada berbagai tahap proyek dan harus menjadi lebih akurat seiring berjalannya waktu.

Selain membuat estimasi biaya untuk seluruh perkiraan biaya proyek dan aktivitas,

penting juga untuk memberikan detail pendukung untuk perkiraan dan pembaruan dokumen proyek. Rincian pendukung termasuk aturan dasar dan asumsi yang digunakan dalam membuat estimasi, deskripsi proyek (seperti pernyataan ruang lingkup dan WBS) yang digunakan sebagai dasar untuk estimasi, dan rincian tentang alat dan teknik estimasi biaya yang digunakan untuk membuat estimasi . Perincian pendukung ini harus mempermudah menyiapkan perkiraan yang diperbarui atau perkiraan serupa yang diperlukan.

Pertimbangan penting lainnya dalam menyiapkan perkiraan biaya adalah biaya tenaga kerja, karena a

persentase besar dari total biaya proyek seringkali merupakan biaya tenaga kerja. Banyak organisasi memperkirakan jumlah orang atau jam yang mereka butuhkan berdasarkan departemen atau keterampilan selama siklus hidup suatu proyek. Misalnya, ketika Northwest Airlines mengembangkan taksiran biaya awal untuk proyek sistem reservasi, ResNet, itu menentukan jumlah maksimum staf penuh waktu yang setara (FTE) yang dapat ditugaskan ke proyek setiap tahun oleh departemen. Tabel 7-3 menunjukkan informasi ini. (Gambar 9-7 dalam Bab 9, Manajemen Sumber Daya Manusia Proyek, menyediakan

informasi sumber daya yang serupa dalam bentuk grafis, di mana jumlah sumber daya disediakan

berdasarkan kategori pekerjaan, seperti analis dan pemrogram bisnis.) Perhatikan sejumlah kecil kontraktor yang direncanakan Northwest Airlines akan digunakan. Biaya tenaga kerja seringkali jauh lebih tinggi

kontraktor, jadi penting untuk membedakan antara sumber daya internal dan eksternal. (Lihat

situs web pendamping untuk teks ini untuk membaca studi kasus terperinci di ResNet, termasuk

perkiraan biaya.)

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$167 million; the largest project cost $33 billion. The most important finding in the study,

however, was the discovery of a large number of gigantic overages when analyzing the

project overrun data. One in six of all projects studied contained a “black swan”: a high-

impact event that is rare and unpredictable, but not improbable in retrospect. These IT

black swan projects had an average cost overrun of 200 percent and a schedule overrun of

almost 70 percent. “This highlights the true pitfall of IT change initiatives: It’s not that

they’re particularly prone to high cost overruns on average, as management consultants

and academic studies have previously suggested. It’s that an unusually large proportion of

them incur massive overages—that is, there are a disproportionate number of black

swans. By focusing on averages instead of the more damaging outliers, most managers and

consultants have been missing the real problem.”2

Obviously, IT projects have room for improvement in meeting cost goals. This chapter

describes important concepts in project cost management, particularly planning cost

management, creating good estimates, and using earned value management (EVM) to

assist in cost control.

WHAT WENT WRONG?

There is no shortage of examples of IT projects that suffered from poor cost management.

The U.S. Internal Revenue Service (IRS) and other government agencies continue to

provide examples of how not to manage costs.

• The IRS managed a series of project failures in the 1990s that cost taxpayers

more than $50 billion a year—roughly as much money as the annual net profit

of the entire computer industry in those years.3

• In 2006, the IRS was again in the news for a botched upgrade to its fraud-

detection software. The IRS planned to launch the system in January, in time for

the 2006 tax season and one year after the original implementation date, but that

did not happen. The U.S. government estimated that the lack of a functioning

anti-fraud system cost $318 million in fraudulent refunds that didn’t get caught.4

• A 2008 Government Accountability Office (GAO) report stated that more than

400 U.S. government agency IT projects, worth an estimated $25 billion, suf-

fered from poor planning and underperformance. U.S. Senator Tom Carper of

Delaware said the IT projects were redundant, lacked clear goals, and were

managed by unqualified people.5

Another example that shows the challenges of managing project costs was the United

Kingdom’s National Health Service (NHS) IT modernization program. Called “the greatest

IT disaster in history” by one London columnist, this 10-year program, which started in

2002, was created to provide an electronic patient records system, appointment booking,

and a prescription drug system in England and Wales. Britain’s Labor government esti-

mates that the program will eventually cost more than $55 billion, a $26 billion overrun.

The program has been plagued by technical problems due to incompatible systems, resis-

tance from physicians who say they were not adequately consulted about system features,

and arguments among contractors about who’s responsible for what.6 A government audit

in June 2006 found that the program, one of the largest civilian IT projects undertaken

continued

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worldwide, was progressing despite high-profile problems. In an effort to reduce cost over-

runs, the NHS program would no longer pay for products until delivery, shifting some

financial responsibility to prime contractors, including BT Group, Accenture, and Fujitsu

Services.7 On September 22, 2011, government officials in the United Kingdom announced

that they were scrapping the National Programme for Health IT. Health Secretary Andrew

Lansley said that the program “let down the NHS and wasted taxpayers’ money.”8

What Is Cost?

A popular cost accounting textbook states, “Accountants usually define cost as a resource

sacrificed or foregone to achieve a specific objective.”9 Webster’s dictionary defines cost as

“something given up in exchange.” Costs are often measured in monetary amounts, such

as dollars, that must be paid to acquire goods and services. (For convenience, the exam-

ples in this chapter use dollars for monetary amounts.) Because projects cost money and

consume resources that could be used elsewhere, it is very important for project managers

to understand project cost management.

Many IT professionals, however, often react to cost overrun information with a smirk.

They know that many of the original cost estimates for IT projects are low or based on

unclear project requirements, so naturally there will be cost overruns. Not emphasizing

the importance of realistic project cost estimates from the outset is only one part of the

problem. In addition, many IT professionals think that preparing cost estimates is a job for

accountants. On the contrary, preparing good cost estimates is a demanding, important

skill that many professionals need to acquire.

Another perceived reason for cost overruns is that many IT projects involve new

technology or business processes. Any new technology or business process is untested and

has inherent risks. Thus, costs grow and failures are to be expected, right? Wrong. Using

good project cost management can change this false perception.

What Is Project Cost Management?

Recall from Chapter 1 that the triple constraint of project management involves balancing

scope, time, and cost goals. Chapters 5 and 6 discuss project scope and time management,

and this chapter describes project cost management. Project cost management includes

the processes required to ensure that a project team completes a project within an

approved budget. Notice two crucial phrases in this definition: “a project” and “approved

budget.” Project managers must make sure their projects are well defined, have accurate

time and cost estimates, and have a realistic budget that they were involved in approving.

It is the project manager’s job to satisfy project stakeholders while continuously striving to

reduce and control costs. There are four processes for project cost management:

1. Planning cost management involves determining the policies, procedures,

and documentation that will be used for planning, executing, and controlling

project cost. The main output of this process is a cost management plan.

2. Estimating costs involves developing an approximation or estimate of the

costs of the resources needed to complete a project. The main outputs of the

cost estimating process are activity cost estimates, basis of estimates, and

project documents updates.

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3. Determining the budget involves allocating the overall cost estimate to indi-

vidual work items to establish a baseline for measuring performance. The

main outputs of the cost budgeting process are a cost baseline, project

funding requirements, and project documents updates.

4. Controlling costs involves controlling changes to the project budget. The

main outputs of the cost control process are work performance information,

cost forecasts, change requests, project management plan updates, project

documents updates, and organizational process assets updates.

Figure 7-1 summarizes these processes and outputs, showing when they occur in a

typical project.

To understand each of the project cost management processes, you must first under-

stand the basic principles of cost management. Many of these principles are not unique to

project management; however, project managers need to understand how these principles

relate to their specific projects.

BASIC PRINCIPLES OF COST MANAGEMENT

Many IT projects are never initiated because IT professionals do not understand the

importance of basic accounting and finance principles. Important concepts such as net

present value analysis, return on investment, and payback analysis were discussed in

Planning

Process: Plan cost management

Outputs: Cost management plan

Process: Estimate costs

Outputs: Activity cost estimates, basis of estimates, project documents

updates

Process: Determine budget

Outputs: Cost baseline, project funding requirements, project

documents updates

Project Start Project Finish

Monitoring and Controlling

Process: Control costs

Outputs: Work performance information, cost forecasts, change requests,

project management plan updates, project documents updates,

organizational process assets updates

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FIGURE 7-1 Project cost management summary

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Chapter 4, Project Integration Management. Likewise, many projects that are started

never finish because of cost management problems. Most members of an executive

board have a better understanding of financial terms than IT terms, and are more

interested in finance. Therefore, IT project managers need to be able to present and

discuss project information both in financial terms and technical terms. In addition to

net present value analysis, return on investment, and payback analysis, project man-

agers must understand several other cost management principles, concepts, and terms.

This section describes general topics such as profits, life cycle costing, cash flow analy-

sis, tangible and intangible costs and benefits, direct costs, sunk costs, learning curve

theory, and reserves. Another important topic—earned value management—is one of

the key tools and techniques for controlling project costs; it is described in detail in the

section on cost control.

Profits are revenues minus expenditures. To increase profits, a company can

increase revenues, decrease expenses, or try to do both. Most executives are more con-

cerned with profits than with other issues. When justifying investments in new informa-

tion systems and technology, it is important to focus on the impact on profits, not just

revenues or expenses. Consider an e-commerce application that you estimate will

increase revenues for a $100 million company by 10 percent. You cannot measure the

potential benefits of the application without knowing the profit margin. Profit margin

is the ratio of revenues to profits. If revenues of $100 generate $2 in profits, there is a

2 percent profit margin. If the company loses $2 for every $100 in revenue, there is

a 2 percent profit margin.

Life cycle costing allows you to see a big-picture view of the cost of a project

throughout its life cycle. This helps you develop an accurate projection of a project’s

financial costs and benefits. Life cycle costing considers the total cost of ownership, or

development plus support costs, for a project. For example, a company might complete

a project to develop and implement a new customer service system in one or two years,

but the new system could be in place for 10 years. Project managers, with assistance

from financial experts in their organizations, should create estimates of the costs and

benefits of the project for its entire life cycle (10 years in the preceding example).

Recall from Chapter 4 that the net present value analysis for the project would

include the entire 10-year period of costs and benefits. Top management and project

managers need to consider the life cycle costs of projects when they make financial

decisions.

Organizations have a history of not spending enough money in the early phases of

IT projects, which affects total cost of ownership. For example, it is much more cost-

effective to spend money on defining user requirements and doing early testing on

IT projects than to wait for problems to appear after implementation. Recall from

Chapter 5 that correcting a software defect late in a project can cost 100 times more

than fixing the defect early.

Because organizations depend on reliable IT, huge costs are associated with down-

time. For example, Table 7-1 summarizes the average cost of a minute of downtime for

different IT applications. Costs include the cost to bring the system back up, staff cost to

make up for the lost work in production during the system downtime, and direct and

indirect lost revenue.

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WHAT WENT RIGHT?

Many organizations use IT to reduce operational costs. For example, a 2008 study

showed that technology has decreased the costs (adjusted for inflation) associated with

processing an ATM transaction from a financial institution:

• In 1968, the average cost was $5.

• In 1978, the cost went down to $1.50.

• In 1988, the cost was just a nickel.

• In 1998, it only cost a penny.

• In 2008, the cost was just half a penny!11

Another cost-cutting strategy has been inspired by the global emphasis on improving

the environment. Investing in green IT and other initiatives has helped both the environ-

ment and companies’ bottom lines. Michael Dell, CEO of Dell, said he aimed to make his

company “carbon neutral” in 2008. “The computer giant is looking to zero-out its carbon

emissions through a number of initiatives, such as offering small businesses and consu-

mers curbside recycling of their old computers, stuffing small recycling bags with free

postage into new printer-ink cartridge boxes, and operating a ‘Plant a Tree for Me’

program.”12 Dell did reach his goal; as of March 2012, Dell had helped its customers save

almost $7 billion in energy costs. Visit www.dell.com/earth for more information.

Cash flow analysis is a method for determining the estimated annual costs and bene-

fits for a project and the resulting annual cash flow. Project managers must conduct cash

flow analysis to determine net present value. Most consumers understand the basic con-

cept of cash flow: If they do not have enough money in their wallets or bank accounts,

they cannot purchase something. Top management must consider cash flow concerns

when selecting projects in which to invest. If top management selects too many projects

that have high cash flow needs in the same year, the company will not be able to support

TABLE 7-1 Costs of downtime for IT applications10

Type of IT Application Cost/Minute

Securities trading $73,000

Enterprise Requirements Planning (ERP) $14,800

Order processing $13,300

Electronic commerce $12,600

Supply chain $11,500

Point of sale (POS) $ 4,700

Automated teller machine (ATM) $ 3,600

E-mail $ 1,900

Source: The Standish Group International, “Trends in IT Value,” www.standishgroup.com (2008).

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all of its projects and maintain its profitability. It is also important to clarify the year used

to analyze dollar amounts. For example, if a company bases all costs on 2012 estimates, it

would need to account for inflation and other factors when projecting costs and benefits in

future-year dollars.

Tangible and intangible costs and benefits are categories for determining how well an

organization can define the estimated costs and benefits for a project. Tangible costs or

benefits can easily be measured in dollars. For example, suppose that the Surveyor Pro

project described in the chapter’s opening case included a preliminary feasibility study. If

a company completed this study for $100,000, its tangible cost is $100,000. If a govern-

ment agency estimated that it could have done the study itself for $150,000, the tangible

benefits of the study would be $50,000 to the government: It could pay Juan’s company

for the study and then assign the government workers who would have done the study to

other projects. Conversely, intangible costs or benefits are difficult to measure in mone-

tary terms. Suppose that Juan and a few other people spent their own personal time using

government-owned computers, books, and other resources to research areas related to the

study. Although their hours and the government-owned materials would not be billed to

the project, they could be considered intangible costs. Intangible benefits for projects

often include items like goodwill, prestige, and general statements of improved productiv-

ity that an organization cannot easily translate into dollar amounts. Because intangible

costs and benefits are difficult to quantify, they are often harder to justify.

Direct costs can be directly related to creating the products and services of the proj-

ect. You can attribute direct costs to a certain project. For example, direct costs include

the salaries of people working full time on the project and the cost of hardware and soft-

ware purchased specifically for the project. Project managers should focus on direct costs

because they can be controlled.

Indirect costs are not directly related to the products or services of the project, but

are indirectly related to performing the project. For example, indirect costs would include

the cost of electricity, paper towels, and other necessities in a large building that houses

1,000 employees who work on many projects. Indirect costs are allocated to projects, and

project managers have very little control over them.

Sunk cost is money that has been spent in the past. Consider it gone, like a sunken

ship that can never be raised. When deciding what projects to invest in or continue, you

should not include sunk costs. For example, in the chapter’s opening case, suppose that

Juan’s office had spent $1 million on a project over the past three years to create a geo-

graphic information system, but had never produced anything valuable. If his government

were evaluating what projects to fund next year and an official suggested continuing to

fund the geographic information system project because $1 million had been spent on it

already, the official would incorrectly be making sunk cost a key factor in the project

selection decision. Many people fall into the trap of continuing to spend money on a failing

project because so much money has been spent on it already. This trap is similar to gam-

blers who continue betting because they have already lost money. Sunk costs should be

forgotten, even though it is often difficult to think that way.

Learning curve theory states that when many items are produced repetitively, the

unit cost of those items decreases in a regular pattern as more units are produced. For

example, suppose that the Surveyor Pro project would potentially produce 1,000 handheld

devices that could run the new software and access information via satellite. The cost of

the first handheld unit would be much higher than the cost of the thousandth unit.

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Learning curve theory should help estimate costs on projects that involve the production

of large quantities of items. Learning curve theory also applies to the amount of time

required to complete some tasks. For example, the first time a new employee performs a

specific task, it will probably take longer than the tenth time that employee performs a

very similar task.

Reserves are dollar amounts included in a cost estimate to mitigate cost risk by

allowing for future situations that are difficult to predict. Contingency reserves allow for

future situations that may be partially planned for (sometimes called known unknowns)

and are included in the project cost baseline. For example, if an organization knows it has

a 20 percent rate of turnover for IT personnel, it should include contingency reserves to

pay for recruiting and training costs of IT personnel. Management reserves allow for future

situations that are unpredictable (sometimes called unknown unknowns). For example,

if a project manager gets sick for two weeks or an important supplier goes out of business,

management reserve could be set aside to cover the resulting costs. Management reserves

are not included in a cost baseline, as you will learn later in this chapter.

PLANNING COST MANAGEMENT

The first step in project cost management is planning how the costs will be managed

throughout the life of the project. Project costs, like project schedules, grow out of the

basic documents that initiate a project, like the project charter. The project manager and

other stakeholders use expert judgment, analytical techniques, and meetings to produce

the cost management plan.

The cost management plan, like the scope and schedule management plans, can be

informal and broad or formal and detailed, based on the needs of the project. In general,

a cost management plan includes the following information:

• Level of accuracy: Activity cost estimates normally have rounding guidelines,

such as rounding to the nearest $100. There may also be guidelines for the

amount of contingency funds to include, such as 10 or 20 percent.

• Units of measure: Each unit used in cost measurements, such as labor hours

or days, should be defined.

• Organizational procedures links: Many organizations refer to the work

breakdown structure (WBS) component used for project cost accounting as

the control account (CA). Each control account is often assigned a unique

code that is used in the organization’s accounting system. Project teams must

understand and use these codes properly.

• Control thresholds: Similar to schedule variance, costs often have a specified

amount of variation allowed before action needs to be taken, such as 10

percent of the baseline cost.

• Rules of performance measurement: If the project uses earned value manage-

ment (EVM), as described later in this chapter, the cost management plan

would define measurement rules, such as how often actual costs will be

tracked and to what level of detail.

• Reporting formats: This section would describe the format and frequency of

cost reports required for the project.

• Process descriptions: The cost management plan would also describe how to

perform all of the cost management processes.

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ESTIMATING COSTS

Project managers must take cost estimates seriously if they want to complete projects

within budget constraints. After developing a good resource requirements list, project

managers and their project teams must develop several estimates of the costs for these

resources. Recall from Chapter 6 that an important process in project time manage-

ment is estimating activity resources, which provides a list of activity resource

requirements. For example, if an activity for a project is to perform a particular type

of test, the list of activity resource requirements would describe the skill level of the

people needed to perform the test, the number of people and hours suggested to

perform the test, the need for special software or equipment, and other requirements.

All of this information is required to develop a good cost estimate. This section

describes various types of cost estimates, tools and techniques for estimating costs,

typical problems associated with IT cost estimates, and a detailed example of a cost

estimate for an IT project.

Types of Cost Estimates

One of the main outputs of project cost management is a cost estimate. Project managers

normally prepare several types of cost estimates for most projects. Three basic types of

estimates include the following:

• A rough order of magnitude (ROM) estimate provides an estimate of what a

project will cost. A ROM estimate can also be referred to as a ballpark esti-

mate, a guesstimate, a swag, or a broad gauge. This type of estimate is done

very early in a project or even before a project is officially started. Project

managers and top management use this estimate to help make project selec-

tion decisions. The timeframe for this type of estimate is often three or

more years prior to project completion. A ROM estimate’s accuracy is typi-

cally 50 percent to þ100 percent, meaning the project’s actual costs could

be 50 percent below the ROM estimate or 100 percent above. For example,

the actual cost for a project with a ROM estimate of $100,000 could range

from $50,000 to $200,000. For IT project estimates, this accuracy range is

often much wider. Many IT professionals automatically double estimates for

software development because of the history of cost overruns on IT projects.

• A budgetary estimate is used to allocate money into an organization’s budget.

Many organizations develop budgets at least two years into the future. Bud-

getary estimates are made one to two years prior to project completion. The

accuracy of budgetary estimates is typically 10 percent to þ25 percent,

meaning the actual costs could be 10 percent less or 25 percent more than

the budgetary estimate. For example, the actual cost for a project with a bud-

getary estimate of $100,000 could range from $90,000 to $125,000.

• A definitive estimate provides an accurate estimate of project costs. Defini-

tive estimates are used for making many purchasing decisions for which

accurate estimates are required and for estimating final project costs.

For example, if a project involves purchasing 1,000 personal computers from

an outside supplier in the next three months, a definitive estimate would be

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required to aid in evaluating supplier proposals and allocating the funds to

pay the chosen supplier. Definitive estimates are made one year or less prior

to project completion. A definitive estimate should be the most accurate of

the three types of estimates. The accuracy of this type of estimate is

normally 5 percent to þ10 percent, meaning the actual costs could be

5 percent less or 10 percent more than the definitive estimate. For example,

the actual cost for a project with a definitive estimate of $100,000 could

range from $95,000 to $110,000. Table 7-2 summarizes the three basic types

of cost estimates.

The number and type of cost estimates vary by application area. For example, the

Association for the Advancement of Cost Engineering (AACE) International identifies five

types of cost estimates for construction projects: order of magnitude, conceptual, prelimi-

nary, definitive, and control. The main point is that estimates are usually done at various

stages of a project and should become more accurate as time progresses.

In addition to creating cost estimates for the entire project and activity cost estimates,

it is also important to provide supporting details for the estimates and updates to project

documents. The supporting details include the ground rules and assumptions used in cre-

ating the estimate, a description of the project (such as scope statement and WBS) used as

a basis for the estimate, and details on the cost estimation tools and techniques used to

create the estimate. These supporting details should make it easier to prepare an updated

estimate or similar estimate as needed.

Another important consideration in preparing cost estimates is labor costs, because a

large percentage of total project costs are often labor costs. Many organizations estimate

the number of people or hours they need by department or skill over the life cycle of a

project. For example, when Northwest Airlines developed initial cost estimates for its res-

ervation system project, ResNet, it determined the maximum number of full-time equiva-

lent (FTE) staff it could assign to the project each year by department. Table 7-3 shows

this information. (Figure 9-7 in Chapter 9, Project Human Resource Management, provides

similar resource information in graphical form, where the number of resources is provided

by job category, such as business analyst and programmer.) Note the small number of

TABLE 7-2 Types of cost estimates

Type of Estimate When Done Why Done How Accurate

Rough order of

magnitude (ROM)

Very early in the project life

cycle, often 3–5 years before

project completion

Provides estimate of cost

for selection decisions

50% to þ100%

Budgetary Early, 1–2 years out Puts dollars in the budget

plans

10% to þ25%

Definitive Later in the project, less than

1 year out

Provides details for

purchases, estimates

actual costs

5% to þ10%

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contractors that Northwest Airlines planned to use. Labor costs are often much higher for

contractors, so it is important to distinguish between internal and external resources. (See

the companion Web site for this text to read the detailed case study on ResNet, including

cost estimates.)

Cost Estimation Tools and Techniques

As you can imagine, developing a good cost estimate is difficult. Fortunately, several tools

and techniques are available to assist in creating one. These tools and techniques include

expert judgment, analogous cost estimating, bottom-up estimating, three-point estimating,

parametric estimating, the cost of quality, project management estimating software, vendor

bid analysis, and reserve analysis.

Analogous estimates, also called top-down estimates, use the actual cost of a previous,

similar project as the basis for estimating the cost of the current project. This technique

requires a good deal of expert judgment and is generally less costly than other techniques,

but it is also less accurate. Analogous estimates are most reliable when the previous projects

are similar in fact, not just in appearance. In addition, the groups preparing cost estimates

must have the needed expertise to determine whether certain parts of the project will be

more or less expensive than analogous projects. For example, estimators often try to find a

similar project and then customize or modify it for known differences. However, if the project

to be estimated involves a new programming language or working with a new type of hard-

ware or network, the analogous estimate technique could easily result in too low an estimate.

Bottom-up estimates involve estimating the costs of individual work items or activities

and summing them to get a project total. This approach is sometimes referred to as

activity-based costing. The size of the individual work items and the experience of the

estimators drive the accuracy of the estimates. If a detailed WBS is available for a project,

the project manager could require each person who is responsible for a work package to

develop a cost estimate for that work package, or at least an estimate of the amount of

resources required. Someone in the financial area of an organization often provides

resource cost rates, such as labor rates or costs per pound of materials, which can be

entered into project management software to calculate costs. The software automatically

calculates information to create cost estimates for each level of the WBS and finally for the

entire project. See Appendix A’s section on project cost management for detailed informa-

tion on entering resource costs and assigning resources to tasks to create a bottom-up

estimate using Project 2010. Using smaller work items increases the accuracy of the cost

TABLE 7-3 Maximum FTE by department by year

Department Year 1 Year 2 Year 3 Year 4 Year 5 Totals

Information systems 24 31 35 13 13 116

Marketing systems 3 3 3 3 3 15

Reservations 12 29 33 9 7 90

Contractors 2 3 1 0 0 6

Totals 41 66 72 25 23 227

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estimate because the people assigned to do the work develop the cost estimate instead of

someone unfamiliar with the work. The drawback with bottom-up estimates is that they

are usually time-intensive and therefore expensive to develop.

Three-point estimates involve estimating the most likely, optimistic, and pessimistic

costs for items. Next, project teams use a formula like the PERT weighted average

described in Chapter 6, take a simple average, or use a Monte Carlo simulation, given the

probability that the estimate is between the optimistic and most likely numbers.

Parametric estimating uses project characteristics (parameters) in a mathematical

model to estimate project costs. For example, a parametric model might provide an esti-

mate of $50 per line of code for a software development project based on the programming

language the project is using, the level of expertise of the programmers, the size and com-

plexity of the data involved, and so on. Parametric models are most reliable when the his-

torical information used to create the model is accurate, the parameters are readily

quantifiable, and the model is flexible in terms of the project’s size. For example, in the

1980s, engineers at McDonnell Douglas Corporation (now part of Boeing) developed a

parametric model for estimating aircraft costs based on a large historical database. The

model’s parameters included the type of aircraft (fighter, cargo, or passenger), how fast the

plane would fly, the thrust-to-weight ratio of the engine, the estimated weights of various

parts of the aircraft, the number of aircraft produced, and the amount of time available to

produce them. In contrast to this sophisticated model, some parametric models involve

very simple heuristics or rules of thumb. For example, a large office automation project

might use a ballpark figure of $10,000 per workstation based on a history of similar office

automation projects developed during the same time period. Parametric models that are

more complicated are usually computerized. See the Suggested Readings on the compan-

ion Web site for examples of parametric models, such as the COCOMO II model. In prac-

tice, many people find that using a combination or hybrid approach with analogous,

bottom-up, three-point, and parametric estimating provides the best cost estimates.

Other considerations when preparing cost estimates are how much to include in

reserves, as described earlier; the cost of quality, as described in Chapter 8, Project

Quality Management; and other cost estimating methods such as vendor bid analysis, as

described in Chapter 12, Project Procurement Management. Using software to assist in cost

estimating is described later in this chapter.

Typical Problems with IT Cost Estimates

Although many tools and techniques can assist in creating project cost estimates, many IT

project cost estimates are still very inaccurate, especially those for new technologies or

software development. Tom DeMarco, a well-known author on software development,

suggests four reasons for these inaccuracies and some ways to overcome them.13

• Estimates are done too quickly. Developing an estimate for a large software

project is a complex task that requires significant effort. Many estimates must

be done quickly and before clear system requirements have been produced.

For example, the Surveyor Pro project described in the opening case involves

a lot of complex software development. Before fully understanding what infor-

mation surveyors need in the system, someone would have to create a ROM

estimate and budgetary estimates for this project. Rarely are the more

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precise, later cost estimates less than the earlier estimates for IT projects. It is

important to remember that estimates are done at various stages of the proj-

ect, and project managers need to explain the rationale for each estimate.

• People lack estimating experience. The people who develop software cost

estimates often do not have much experience with cost estimation, especially

for large projects. They also do not have enough accurate, reliable project

data on which to base estimates. If an organization uses good project manage-

ment techniques and develops a history of keeping reliable project informa-

tion, including estimates, the organization’s estimates should improve.

Enabling IT people to receive training and mentoring on cost estimating will

also improve cost estimates.

• Human beings are biased toward underestimation. For example, senior IT

professionals or project managers might make estimates based on their own

abilities and forget that many younger people will be working on a project.

Estimators might also forget to allow for extra costs needed for integration and

testing on large IT projects. It is important for project managers and top

management to review estimates and ask important questions to make sure

the estimates are not biased.

• Management desires accuracy. Management might ask for an estimate but really

want a more accurate number to help them create a bid to win a major contract

or get internal funding. This problem is similar to the situation discussed in

Chapter 6, Project Time Management, in which top managers or other stake-

holders want project schedules to be shorter than the estimates. It is important for

project managers to help develop good cost and schedule estimates and to use

their leadership and negotiation skills to stand by those estimates.

It is also important to be cautious with initial estimates. Top management never for-

gets the first estimate and rarely, if ever, remembers how approved changes affect the

estimate. It is a never-ending and crucial process to keep top management informed about

revised cost estimates. It should be a formal process, albeit a possibly painful one.

Sample Cost Estimate

One of the best ways to learn how the cost estimating process works is by studying sample cost

estimates. Every cost estimate is unique, just as every project is unique. You can see a short

sample cost estimate in Chapter 3 for JWD Consulting’s project management intranet site

project. You can also view the ResNet cost estimate on the companion Web site for this text.

This section includes a step-by-step approach for developing a cost estimate for the

Surveyor Pro project described in the opening case. Of course, it is much shorter and

simpler than a real cost estimate, but it illustrates a process to follow and uses several of

the tools and techniques described earlier. For more detailed information on creating a

cost estimate, see the NASA Cost Estimating Handbook and other references provided in

the Suggested Readings on the companion Web site.

Before beginning a cost estimate, you must first gather as much information as possi-

ble about the project and ask how the organization plans to use the cost estimate. If the

cost estimate will be the basis for contract awards and performance reporting, it should be

a definitive estimate and as accurate as possible, as described earlier.

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It is also important to clarify the ground rules and assumptions for the estimate. The

Surveyor Pro project cost estimate includes the following ground rules and assumptions:

• This project was preceded by a detailed study and proof of concept to show

that it was possible to develop the hardware and software needed by surveyors

and link the new devices to existing information systems. The proof of con-

cept project produced a prototype handheld device and much of the software

to provide basic functionality and link to the Global Positioning System (GPS)

and other government databases used by surveyors. Some data is available to

help estimate future labor costs, especially for the software development, and

to help estimate the cost of the handheld devices.

• The main goal of this project is to produce 100 handheld devices, continue

developing the software (especially the user interface), test the new system

in the field, and train 100 surveyors in selected cities to use the new system.

A follow-up contract is expected for a much larger number of devices based

on the success of this project.

• The project has the following WBS:

1. Project management

2. Hardware

2.1 Handheld devices

2.2 Servers

3. Software

3.1 Licensed software

3.2 Software development

4. Testing

5. Training and support

6. Reserves

• Costs must be estimated by WBS and by month. The project manager will

report progress on the project using earned value analysis, which requires this

type of estimate.

• Costs will be provided in U.S. dollars. Because the project length is one year,

inflation will not be included.

• The project will be managed by the government’s project office. The project

will require a part-time project manager and four team members. The team

members will help manage various parts of the project and provide their

expertise in the areas of software development, training, and support. Their

total hours will be allocated as follows: 25 percent to project management,

25 percent to software development, 25 percent to training and support, and

25 percent to non-project work.

• The project involves purchasing the handheld devices from the same com-

pany that developed the prototype device. Based on producing 100 devices,

the cost rate is estimated to be $600 per unit. The project will require four

additional servers to run the software required for the devices and for manag-

ing the project.

• The project requires purchased software licenses for accessing the GPS and

three other external systems. Software development includes developing a

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graphical user interface for the devices, an online help system, and a new

module for tracking surveyor performance using the device.

• Testing costs should be low due to the success of the prototype project. An

estimate based on multiplying the total hardware and software estimates by

10 percent should be sufficient.

• Training will include instructor-led classes in five different locations.

The project team believes it will be best to outsource most of the training,

including developing course materials, holding the sessions, and providing

help desk support for three months as the surveyors start using their

devices in the field.

• Because several risks are related to this project, include 20 percent of the

total estimate as reserves.

• You must develop a computer model for the estimate so that you can easily

change several inputs, such as the number of labor hours for various activities

or labor rates.

Fortunately, the project team can easily access cost estimates and actual information

from similar projects. A great deal of information is available from the proof of concept

project, and the team can also talk to contractors from the past project to help them

develop the estimate. Computer models are also available, such as a software-estimating

tool based on function points.

Because the estimate must be provided by WBS and by month, the team first reviews a

draft of the project schedule and makes further assumptions as needed. The team decides

first to estimate the cost of each WBS item and then determine when the work will be per-

formed, even though costs may be incurred at different times than when the work is per-

formed. The team’s budget expert has approved this approach for the estimate. The team has

further assumptions and information for estimating the costs for each WBS category:

1. Project management: Estimate based on compensation for the part-time

project manager and 25 percent of team members’ time. The budget expert

for this project suggested using a labor rate of $100/hour for the project man-

ager and $75/hour for each team member, based on working an average of

160 hours per month, full time. Therefore, the total hours for the project

manager under this category are 960 (160/2 \* 12 1⁄4 960). Costs are also

included for the four project team members each working 25 percent of their

time: a total of 160 hours per month for all project personnel (160 \* 12 1⁄4

1920). An additional amount will be included for all contracted labor; it is

estimated by multiplying 10 percent of the total estimates for software devel-

opment and testing costs (10% \* ($594,000 þ $69,000)).

2. Hardware

2.1 Handheld devices: 100 devices estimated by contractor at $600 per

unit.

2.2 Servers: Four servers estimated at $4,000 each, based on recent server

purchases.

3. Software

3.1 Licensed software: License costs will be negotiated with each supplier.

Because there is a strong probability of large future contracts and great

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publicity if the system works well, costs are expected to be lower than

usual. A cost of $200/handheld device will be used.

3.2 Software development: This estimate will include two approaches: a labor

estimate and a function point estimate. The higher estimate will be used. If

the estimates are more than 20 percent apart, the project will require a

third approach to providing the estimate. The supplier who developed the

proof of concept project will provide the labor estimate input, and local

technical experts will make the function point estimates.

4. Testing: Based on similar projects, testing will be estimated as 10 percent of

the total hardware and software cost.

5. Training and support: Based on similar projects, training will be estimated

on a per-trainee basis, plus travel costs. The cost per trainee (100 total) will

be $500, and travel will cost $700/day/person for the instructors and project

team members. The team estimates that the project will require a total of 12

travel days. Labor costs for the project team members will be added to this

estimate because they will assist in training and providing support after the

training. The labor hours estimate for team members is 1,920 hours total.

6. Reserves: As directed, reserves will be estimated at 20 percent of the total

estimate.

The project team then develops a cost model using the preceding information.

Figure 7-2 shows a spreadsheet that summarizes the costs by WBS item. Notice that the

Surveyor Pro Project Cost Estimate Created October 5

# Units/Hrs. Cost/Unit/Hr. Subtotals WBS Level 2 Totals % of Total

WBS Items

1. Project Management $306,300 20%

Project manager $100 $96,000

Project team members $75 $144,000

Contractors (10% of software

development and testing) $66,300

2. Hardware $76,000 5%

2.1 Handheld devices $600 $60,000

2.2 Servers $4,000 $16,000

3. Software $614,000 40%

3.1 Licensed software $200 $20,000

3.2 Software development\* $594,000

4. Testing (10% of total hardware

and software costs) $69,000 $69,000 5%

5. Training and Support $202,400 13%

Trainee cost $500 $50,000

Travel cost $700 $8,400

Project team members $75 $144,000

6. Reserves (20% of total estimate) $253,540 $253,540 17%

Total project cost estimate $1,521,240

\*See software development estimate.

960

1920

100

4

100

100

12

1920

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FIGURE 7-2 Surveyor Pro project cost estimate

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WBS items are listed in the first column, and sometimes the items are broken down

into more detail based on how the costs are estimated. For example, the project man-

agement category includes three items to calculate costs for the project manager, the

project team members, and the contractors, because all of them will perform some

project management activities. Also notice the columns for entering the number of

units or hours and the cost per unit or hour. Several items are estimated using this

approach. The estimate includes some short comments, such as reserves being 20 per-

cent of the total estimate. Also notice that you can easily change several input vari-

ables, such as number of hours or cost per hour, to revise the estimate.

The asterisk by the software development item in Figure 7-2 provides another refer-

ence for detailed information on how this more complicated estimate was made. Recall the

assumption that software development must be estimated using two approaches, and that

the higher estimate would be used as long as both estimates were no more than 20 percent

apart. The labor estimate was used in this case because it was slightly higher than the

function point estimate ($594,000 versus $562,158). Details are provided in Figure 7-3 to

explain how the function point estimate was made. As you can see, many assumptions

were made in producing the function point estimate. Again, by putting the information

into a cost model, you can easily change several inputs to adjust the estimate. See the

referenced article and other sources for more information on function point estimates.

It is very important to have several people review the project cost estimate. It is also

helpful to analyze the total dollar value as well as the percentage of the total amount for

each major WBS category. For example, a senior executive could quickly look at the Sur-

veyor Pro project cost estimate and decide if the numbers are reasonable and the assump-

tions are well documented. In this case, the government had budgeted $1.5 million for the

Surveyor Pro Software Development Estimate Created October 5

1. Labor Estimate # Units/Hrs. Cost/Unit/Hr. Subtotals Calculations

Contractor labor estimate 3000 $150 $450,000 3000 150

Project team member estimate 1920 $75 $144,000 1920 75

Total labor estimate $594,000 Sum above two values

2. Function point estimate\*\* Quantity Conversion

Factor

Function

Points

Calculations

External inputs 10 4 40 10 4

External interface files 3 7 21 3 7

External outputs 4 5 20 4 5

External queries 6 4 24 6 4

Logical internal tables 7 10 70 7 10

Total function points 175 Sum above function point

values

Java 2 languange equivalency

value

46 Assumed value from

reference

Source lines of code (SLOC) estimate 8,050 175 46

Productivity×KSLOC^Penalty

(in months)

29.28 3.13 8.05^1.072

(see reference)

Total labor hours (160 hours/month) 4,684.65 29.28 160

Cost/labor hour ($120/hour) $120 Assumed value from

budget expert

Total function point estimate $562,158 4684.65 120

\*\*Approach based on paper by William Roetzheim, “Estimating Software Costs,” Cost Xpert Group, Inc.

(2003) using the COCOMO II default linear productivity factor (3.13) and penalty factor (1.072).

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FIGURE 7-3 Surveyor Pro software development estimate

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project, so the estimate was in line with that amount. The WBS Level 2 items, such as

project management, hardware, software, and testing, also seemed to be at appropriate

percentages of the total cost based on similar past projects. In some cases, a project team

might also be asked to provide a range estimate for each item instead of one discrete

amount. For example, the team might estimate that the testing costs will be between

$60,000 and $80,000 and document their assumptions in determining those values. It is

also important to update cost estimates, especially if any major changes occur on a

project.

After the total cost estimate is approved, the team can then allocate costs for each

month based on the project schedule and when costs will be incurred. Many organizations

also require that the estimated costs be allocated into certain budget categories, as

described in the next section.

DETERMINING THE BUDGET

Determining the budget involves allocating the project cost estimate to individual material

resources or work items over time. These material resources or work items are based on

the activities in the work breakdown structure for the project. The cost management plan,

scope baseline, activity cost estimates, basis of estimates, project schedule, resource

calendars, risk register, agreements, and organizational process assets are all inputs for

determining the budget. The main goal of the cost budgeting process is to produce a cost

baseline for measuring project performance and to determine project funding require-

ments. The process may also result in project documents updates, such as items being

added, removed, or modified in the scope statement or project schedule.

For example, the Surveyor Pro project team could use the cost estimate from

Figure 7-2 along with the project schedule and other information to allocate costs for

each month. Figure 7-4 provides an example of a cost baseline for this project. A cost

baseline is a time-phased budget that project managers use to measure and monitor

cost performance. Again, it’s important for team members to document assumptions

they made when developing the cost baseline and have several experts review it.

WBS Items

1. Project Management

1.1 Project manager 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 8,000 96,000

1.2 Project team members 12,000 12,000 12,000 12,000 12,000 12,000 12,000 12,000 12,000 12,000 12,000 12,000 144,000

1.3 Contractors 6,027 6,027 6,027 6,027 6,027 6,027 6,027 6,027 6,027 6,027 6,027 66,300

2. Hardware

2.1 Handheld devices 30,000 30,000 60,000

2.2 Servers 8,000 8,000 16,000

3. Software

3.1 Licensed software 10,000 10,000 20,000

3.2 Software development 60,000 60,000 80,000 127,000 127,000 90,000 50,000 594,000

4. Testing 6,000 8,000 12,000 15,000 15,000 13,000 69,000

5. Training and Support

5.1 Trainee cost 50,000 50,000

5.2 Travel cost 8,400 8,400

5.3 Project team members 24,000 24,000 24,000 24,000 24,000 24,000 144,000

6. Reserves 10,000 10,000 30,000 30,000 60,000 40,000 40,000 30,000 3,540 253,540

Totals 20,000 86,027 92,027 172,027 223,027 198,027 185,027 173,027 148,427 90,027 80,027 53,567 1,521,240

1 2 3 4 5 6 7 8 9 10 11 12 Totals

\*See the lecture slides for this chapter on the companion Web site for a larger view of this and other

figures in this chapter. Numbers are rounded, so some totals appear to be off.

Surveyor Pro Project Cost Baseline Created October 10\*

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FIGURE 7-4 Surveyor Pro project cost baseline

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Most organizations have a well-established process for preparing budgets. For exam-

ple, many organizations require budget estimates to include the number of FTE for each

month of the project. One FTE normally means 40 hours of work. One person could be

assigned full-time to a project to provide one FTE, or two people could be assigned half-

time to provide one FTE. This number provides the basis for estimating total compensa-

tion costs each year. Many organizations also want to know the amount of money pro-

jected to be paid to suppliers for their labor costs or other purchased goods and services.

Other common budget categories include travel, depreciation, rents and leases, and other

supplies and expenses. It is important to understand these budget categories before devel-

oping an estimate to make sure data is collected accordingly. Organizations use this infor-

mation to track costs across projects and non-project work and to look for ways to reduce

costs. They also use the information for legal and tax purposes.

In addition to providing input for budgetary estimates, cost budgeting provides a cost

baseline. Estimating costs for each major project activity over time provides project man-

agers and top management with a foundation for project cost control, as described in the

next section. See Appendix A for information on using Project 2010 for cost control.

Cost budgeting, as well as requested changes or clarifications, may result in updates to

the cost management plan, which is a subsidiary part of the project management plan.

Cost budgeting also provides information for project funding requirements. For example,

some projects have all funds available when the project begins, but others must rely on

periodic funding to avoid cash flow problems. If the cost baseline shows that more funds

are required in certain months than are expected to be available, the organization must

make adjustments to avoid financial problems.

MEDIA SNAPSHOT

Anyone who has run for public office or worked on a political campaign knows how

expensive they can be. Barack Obama and his campaign leaders understood how to use

modern media and technology to raise money and find volunteers for his successful

campaign to become the 44th President of the United States.

• The Obama campaign used 16 different online social platforms, including

Facebook, LinkedIn (business networkers), MySpace (youth), YouTube (video),

Flickr (images), Digg (social bookmarking), Twitter (mobile), BlackPlanet

(African-Americans), Eons (baby boomers), GLEE (gays and lesbians), and

MiGente (Latinos), to interact with people from various backgrounds. Sources

said that 80 percent of all contributions originated from these social networks,

and some say 90 percent of all contributions (which totaled over $600 million)

were less than $100 apiece.14

• In a 60 Minutes broadcast shortly after the election, campaign leaders

discussed details of the campaign. David Axelrod, Obama’s chief strategist,

recalled, “When we started the campaign, we met around a table like this. And

there was just a handful of us. You know, we started with nothing. And Barack

said to us, ‘I want this to be a grassroots campaign. I wanna reinvigorate our

continued

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democracy. First of all I think that’s the only way we can win and secondly

I want to rekindle some idealism that together we can get things done in this

country.’ ”15

• The Web site My.BarackObama.org was created to develop an online com-

munity with over a million members. Users could get access to the tools they

needed to effectively organize on a local level to help elect Obama. For exam-

ple, the site helped users find local events and groups, contact undecided voters

in their areas, and share their stories on blogs. Obama spread his message and

invigorated millions of people to support him.

CONTROLLING COSTS

Controlling project costs includes monitoring cost performance, ensuring that only

appropriate project changes are included in a revised cost baseline, and informing project

stakeholders of authorized changes to the project that will affect costs. The project man-

agement plan, project funding requirements, work performance data, and organizational

process assets are inputs for controlling costs. Outputs of this process are work perfor-

mance information, cost forecasts, change requests, project management plan updates,

project documents updates, and organizational process asset updates.

Several tools and techniques assist in project cost control. As shown in Appendix A,

Project 2010 has many cost management features to help you enter budgeted costs, set a

baseline, enter actuals, calculate variances, and run various cost reports. In addition to

using software, however, you need a change control system to define procedures for chang-

ing the cost baseline. This cost control change system is part of the integrated change con-

trol system described in Chapter 4, Project Integration Management. Because many

projects do not progress exactly as planned, new or revised cost estimates are often

required, as are estimates to evaluate alternate courses of action. Performance review

meetings can be a powerful tool for helping to control project costs. People often perform

better when they know they must report on their progress. Another very important tool for

cost control is performance measurement. Although many general accounting approaches

are available for measuring cost performance, earned value management (EVM) is a power-

ful cost control technique that is unique to the field of project management.

Earned Value Management

Earned value management (EVM) is a project performance measurement technique that

integrates scope, time, and cost data. Given a cost performance baseline, project managers

and their teams can determine how well the project is meeting scope, time, and cost goals by

entering actual information and then comparing it to the baseline. A baseline is the figure in

the original project plan plus approved changes. Actual information includes whether or not

a WBS item was completed, approximately how much of the work was completed, when the

work actually started and ended, and how much the completed work actually cost.

In the past, earned value management was used primarily on large government pro-

jects. Today, however, more and more companies are realizing the value of using this tool

to help control costs. In fact, a discussion by several academic experts in earned value

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management and a real practitioner revealed the need to clarify how to calculate earned

value. Brenda Taylor, a senior project manager for P2 Project Management Solutions in

Johannesburg, South Africa, questioned the accuracy of calculating earned value simply by

multiplying the planned value to date by a percentage complete value. She suggested using

the rate of performance instead, as described below.

Earned value management involves calculating three values for each activity or sum-

mary activity from a project’s WBS.

1. The planned value (PV), also called the budget, is the portion of the approved

total cost estimate planned to be spent on an activity during a given period.

Table 7-4 shows an example of earned value calculations. Suppose that a

project included a summary activity of purchasing and installing a new Web

server. Suppose further that, according to the plan, it would take one week

and cost a total of $10,000 for the labor hours, hardware, and software.

Therefore, the planned value (PV) for the activity that week is $10,000.

2. The actual cost (AC) is the total direct and indirect costs incurred in accom-

plishing work on an activity during a given period. For example, suppose that

it actually took two weeks and cost $20,000 to purchase and install the new

Web server. Assume that $15,000 of these actual costs were incurred during

Week 1 and $5,000 was incurred during Week 2. These amounts are the

actual cost (AC) for the activity each week.

3. The earned value (EV) is an estimate of the value of the physical work actu-

ally completed. EV is based on the original planned costs for the project or

activity and the rate at which the team is completing work on the project or

activity to date. The rate of performance (RP) is the ratio of actual work

completed to the percentage of work planned to have been completed at any

given time during the life of the project or activity. For example, suppose that

the server installation was halfway completed by the end of Week 1. The rate

of performance would be 50 percent because by the end of Week 1, the

planned schedule reflects that the task should be complete but only 50 per-

cent of the work has been completed. In Table 7-4, the earned value estimate

after one week is therefore $5,000.16

TABLE 7-4 Earned value calculations for one activity after Week 1

Activity Week 1

Earned value (EV) 5,000

Planned value (PV) 10,000

Actual cost (AC) 15,000

Cost variance (CV) 10,000

Schedule variance (SV) 5,000

Cost performance index (CPI) 33%

Schedule performance index (SPI) 50%

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The earned value calculations in Table 7-4 are carried out as follows:

EV 1⁄4 10,000 50% 1⁄4 5,000

CV 1⁄4 5,000 15,000 1⁄4 10,000

SV 1⁄4 5,000 10,000 1⁄4 5,000

CPI 1⁄4 5,000=15,000 1⁄4 33%

SPI 1⁄4 5,000=10,000 1⁄4 50%

Table 7-5 summarizes the formulas used in earned value management. Note that the

formulas for variances and indexes start with EV, the earned value. Variances are calcu-

lated by subtracting the actual cost or planned value from EV, and indexes are calculated

by dividing EV by the actual cost or planned value. After you total the EV, AC, and PV data

for all activities on a project, you can use the CPI and SPI to project how much it will cost

and how long it will take to finish the project based on performance to date. Given the

budget at completion and original time estimate, you can divide by the appropriate index

to calculate the estimate at completion (EAC) and estimated time to complete, assuming

that performance remains the same. There are no standard acronyms for the terms

estimated time to complete or original time estimate.

Cost variance (CV) is the earned value minus the actual cost. If cost variance is a

negative number, it means that performing the work cost more than planned. If cost

variance is a positive number, performing the work cost less than planned.

Schedule variance (SV) is the earned value minus the planned value. A negative

schedule variance means that it took longer than planned to perform the work, and a pos-

itive schedule variance means that the work took less time than planned to perform.

The cost performance index (CPI) is the ratio of earned value to actual cost; it can be

used to estimate the projected cost of completing the project. If the CPI is equal to one, or

100 percent, then the planned and actual costs are equal—the costs are exactly as bud-

geted. If the CPI is less than one or less than 100 percent, the project is over budget. If the

CPI is greater than one or more than 100 percent, the project is under budget.

TABLE 7-5 Earned value formulas

Term Formula

Earned value (EV) EV 1⁄4 PV to date \* RP

Cost variance (CV) CV 1⁄4 EV AC

Schedule variance (SV) SV 1⁄4 EV PV

Cost performance index (CPI) CPI 1⁄4 EV/AC

Schedule performance index (SPI) SPI 1⁄4 EV/PV

Estimate at completion (EAC) EAC 1⁄4 BAC/CPI

Estimated time to complete Original time estimate/SPI

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The schedule performance index (SPI) is the ratio of earned value to planned value; it

can be used to estimate the projected time to complete the project. Similar to the cost

performance index, an SPI of one, or 100 percent, means the project is on schedule. If the

SPI is greater than one or 100 percent, then the project is ahead of schedule. If the SPI is

less than one or 100 percent, the project is behind schedule.

Note that in general, negative numbers for cost and schedule variance indicate

problems in those areas. Negative numbers mean the project is costing more than

planned or taking longer than planned. Likewise, a CPI and SPI of less than one or less

than 100 percent also indicate problems.

The cost performance index can be used to calculate the estimate at completion

(EAC)—an estimated cost of completing a project based on performance to date. Similarly,

the schedule performance index can be used to calculate an estimated time to complete

the project.

You can graph earned value information to track project performance. Figure 7-5

shows an earned value chart for a one-year project after five months. Note that the actual

cost and earned value lines end at five months because the data was collected or estimated

at that point. The chart includes three lines and two points, as follows:

• Planned value (PV), the cumulative planned amounts for all activities by

month. Note that the planned value line extends for the estimated length of

the project and ends at the BAC point.

• Actual cost (AC), the cumulative actual amounts for all activities by month.

• Earned value (EV), the cumulative earned value amounts for all activities by

month.

120,000

Month

80,000

60,000

40,000

20,000

-

$

Earned value (EV)

12345678

100,000

9 10 11

Actual cost (AC)

Planned value (PV)

Budget at completion (BAC)

Estimate at completion (EAC)

12 13

An EAC

point above

and to the

right of the

BAC point

means the

project is

projected to

cost more

and take

longer than

planned

Actual cost (AC) Planned value (PV) Earned value (EV)

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FIGURE 7-5 Earned value chart for project after five months

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• Budget at completion (BAC), the original total budget for the project, or

$100,000 in this example. The BAC point is plotted on the chart at the origi-

nal time estimate of 12 months.

• Estimate at completion (EAC), estimated to be $122,308 in this example. This

number is calculated by taking the BAC, or $100,000 in this case,

and dividing by the CPI, which was 81.761 percent. This EAC point is plotted

on the chart at the estimated time to complete of 12.74 months. This number

is calculated by taking the original time estimate, or 12 months in this case,

and dividing by the SPI, which in this example was 94.203 percent.

Viewing earned value information in chart form helps you visualize how the project is

performing. For example, you can see the planned performance by looking at the planned

value line. If the project goes as planned, it will finish in 12 months and cost $100,000.

Notice in the example in Figure 7-5 that the actual cost line is always on or above the

earned value line, which indicates that costs are equal to or more than planned. The

planned value line is close to the earned value line, and is slightly higher in the last month.

This relationship means that the project has been on schedule until the last month, when

the project fell behind schedule.

Top managers who oversee multiple projects often like to see performance information

in a graphical form, such as the earned value chart in Figure 7-5. For example, in the opening

case, the government officials were reviewing earned value charts and EACs for several dif-

ferent projects. Earned value charts allow you to see quickly how projects are performing. If

there are serious cost and schedule performance problems, top management may decide to

terminate projects or take other corrective action. The EACs are important inputs to budget

decisions, especially if total funds are limited. Earned value management is an important

technique when used effectively, because it helps top management and project managers

evaluate progress and make sound management decisions. Consult the PMBOK® Guide and

other resources for more information and calculations about earned value.

If earned value management is such a powerful cost control tool, then why doesn’t

every organization use it? Why do many government projects require it, but many com-

mercial projects don’t? Two reasons are EVM’s focus on tracking actual performance ver-

sus planned performance and the importance of percentage completion data in making

calculations. Many projects, particularly IT projects, do not have good planning informa-

tion, so tracking performance against a plan might produce misleading information. Sev-

eral cost estimates are usually made on IT projects, and keeping track of the most recent

cost estimate and the associated actual costs could be cumbersome. In addition, estimating

percentage completion of tasks might produce misleading information. What does it mean

to say that a task is actually 75 percent complete after three months? Such a statement is

often not synonymous with saying the task will be finished in one more month or after

spending an additional 25 percent of the planned budget.

To make earned value management simpler to use, organizations can modify the level

of detail and still reap the benefits of the technique. For example, you can use percentage

completion data such as 0 percent for items not yet started, 50 percent for items in prog-

ress, and 100 percent for completed tasks. As long as the project is defined in enough

detail, this simplified percentage completion data should provide enough summary infor-

mation to allow managers to see how well a project is doing overall. You can get very

accurate total project performance information using these simple percentage complete

amounts. For example, using simplified percentage complete amounts for a one-year

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project with weekly reporting and an average task size of one week, you can expect about

a 1 percent error rate.17

You can only enter and collect earned value data at summary levels of the WBS.

Quentin Fleming, author of the book Earned Value Project Management,

18 often gives

presentations about earned value management. Many people express their frustration

in trying to collect such detailed information. Fleming explains that you do not have

to collect information at the work package level to use earned value management. It is

most important to have a deliverable-oriented WBS, and many WBS items can summarize

several subdeliverables. For example, you might have a WBS for a house that includes

items for each room in the house. Just collecting earned value data for each room would

provide meaningful information instead of trying to collect detailed information for each

component in the room, such as flooring, furniture, and lighting.

It is important to remember that the heart and soul of EVM are estimates. The entire

EVM process begins with an estimate; when the estimate is off, all the calculations will be

off. Before an organization attempts to use EVM, it must learn to develop good estimates.

Earned value management is the primary method available for integrating performance,

cost, and schedule data. It can be a powerful tool for project managers and top manage-

ment to use in evaluating project performance. Project management software, such as

Project 2010, includes tables for collecting earned value data and reports that calculate

variance information. Project 2010 also allows you to easily produce an earned value

chart, similar to the one in Figure 7-5, without importing the data into Microsoft Excel. See

the project cost management section of Appendix A for an example of using earned value

management and the Suggested Readings on the companion Web site for more informa-

tion. Another approach to evaluating the performance of multiple projects is project

portfolio management, as described in the following section.

GLOBAL ISSUES

The Project Management Institute conducted a major study in 2011 to help understand and

gauge the current level of EVM practice. The researchers surveyed more than 600 project

management practitioners in 61 countries, providing a cross-sectional view of the most current

EVM practices. Respondents were classified by industry sector, motivation for EVM usage,

organizational role, and geographic location. The study included the following key findings:

• EVM is used worldwide, and it is particularly popular in the Middle East, South

Asia, Canada, and Europe.

• Most countries require EVM for large defense or government projects, as shown

in Figure 7-6.

• EVM is also used in such private-industry sectors as IT, construction, energy,

and manufacturing. However, most private companies have not yet applied

EVM to their projects because management does not require it, feeling it is too

complex and not cost effective.

• The level of EVM use and maturity varies among organizations and projects,

but budget size appears to be the most important decision factor.

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• EVM’s contributions and cost effectiveness are widely recognized; most respon-

dents said they agree or strongly agree that EVM provides early warning signs,

helping them to control project scope, time, and cost. EVM’s contribution to

cost performance was ranked higher than schedule performance, and the

difference was statistically significant.

• Top barriers to enhanced use of EVM were lack of motivation and lack of

expertise.

• Top management support, buy-in of project staff, training, organizational

culture and leadership, and maturity of the project management system

were the most important factors in successful use of EVM.19

Project Portfolio Management

As you saw in Chapter 1, many organizations now collect and control an entire suite of pro-

jects or investments as one set of interrelated activities in one place—a portfolio. Several

software tools provide graphics to summarize performance on a portfolio of projects, as

shown in Chapter 4. Key metrics, including cost performance, are often shown in green,

yellow, or red, indicating that things are going as planned, that problems exist, or that major

problems exist, respectively. Project managers need to understand how their projects fit into

the bigger picture, and they need to help their organizations make wise investment decisions.

19.5

51.3

29.2

31.9 32.2

35.8

0

10

20

30

40

50

60

A few pilot

projects

Large and critical

projects

Organization-wide

standard for

all projects

Percentage

Defense/Government Private industry

Source: Lingguang Song, “Earned Value Management: A Global and Cross-Industry Perspective on Current EVM Practice,”

PMI (2011)

FIGURE 7-6 Earned value usage

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Many project managers also want to move on to manage larger projects, become program

managers, then vice presidents, and eventually CEOs. Understanding project portfolio man-

agement, therefore, is important for project and organizational success.

There can be a portfolio for IT projects, for example, and portfolios for other types of

projects. An organization can view project portfolio management as having five levels, from

simplest to most complex, as follows:

1. Put all your projects in one database.

2. Prioritize the projects in your database.

3. Divide your projects into two or three budgets based on type of investment,

such as utilities or required systems to keep things running, incremental

upgrades, and strategic investments.

4. Automate the repository.

5. Apply modern portfolio theory, including risk-return tools that map project

risk on a curve.

For example, Jane Walton, the project portfolio manager for IT projects at Schlumber-

ger, saved the company $3 million in one year by organizing the organization’s 120

IT projects into a portfolio. Manufacturing companies have used project portfolio manage-

ment since the 1960s, and Walton anticipated the need to justify investments in IT projects

just as managers have to justify capital investment projects. She found that 80 percent of the

organization’s projects overlapped, and that 14 separate projects were trying to accomplish

the same thing. Other managers, such as Douglas Hubbard, president of a consulting firm, see

the need to use project portfolio management, especially for IT projects. Hubbard suggests,

“IT investments are huge, risky investments. It’s time we do this.”20

Project portfolio managers can start by using spreadsheet software to develop and man-

age project portfolios, or they can use sophisticated software designed to help manage project

portfolios. Several software tools available today help project portfolio managers summarize

earned value and project portfolio information, as described in the following section.

Although many organizations have adopted project portfolio management tools and techni-

ques for IT projects (including portfolio management software), they are not following best

practices to truly reap the benefits, as described in the following Best Practice feature.

BEST PRACTICE

A global survey released by Borland Software in 2006 suggests that many organizations

are still at a low level of maturity in terms of how they define project goals, allocate

resources, and measure overall success of their IT portfolios. Approximately 54 percent

of survey respondents were from the Americas, 32 percent were from the Asia-Pacific

area, and 14 percent were from Europe, the Middle East, and Africa. The study published

some of the following findings:

• Only 22 percent of survey respondents reported that their organization either

effectively or very effectively uses a project plan for managing projects.

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• Only 17 percent have either rigorous or very rigorous processes for project

plans, which include developing a baseline and estimating schedule, cost, and

business impact of projects.

• Only 20 percent agreed that their organizations monitor portfolio progress and

coordinate across interdependent projects.

• The majority of respondents agreed that their organization has no business

impact assessment for completed projects, and that success is measured only at

the project level, based on performance against schedule and budget.

• Just two percent of survey respondents felt their organization was very effective

at measuring performance of the overall portfolio.

According to Branndon Stewart, director of Information Technology Management

and Governance products at Borland, “The most successful organizations are taking a

holistic view of focusing, managing, and measuring their IT efforts with an integrated

combination of best practice processes, training and technology. Unfortunately, most

organizations today still aren’t taking this approach. ... IT leaders understand the value of

a balanced portfolio aligned with business objectives, but most lack a well-defined and

consistent process for managing the origination, evaluation, and execution of IT

investments.” Stewart continued, “Portfolio management enables IT to make fact-based

investment decisions in unison with business stakeholders, thus ensuring alignment,

improving visibility, and shifting the burden of investment decisions from the CIO to all

stakeholders.”21

USING PROJECT MANAGEMENT SOFTWARE TO ASSIST

IN PROJECT COST MANAGEMENT

Most organizations use software to assist in various activities related to project cost man-

agement. Spreadsheets are a common tool for cost estimating, cost budgeting, and cost

control. Many companies also use more sophisticated and centralized financial applica-

tions software to provide important cost-related information to accounting and finance

personnel. This section focuses on how you can use project management software in cost

management. Appendix A includes a section on using the cost management features in

Project 2010.

Project management software can be a very helpful tool during each process of project

cost management. It can help you study overall project information or focus on tasks that

are over a specified cost limit. You can use the software to assign costs to resources and

tasks, prepare cost estimates, develop cost budgets, and monitor cost performance. Project

2010 has several standard cost reports: cash flow, budget, over-budget tasks, over-budget

resources, and earned value reports. For several of these reports, you must enter percent-

age completion information and actual costs, just as you do when manually calculating

earned value or other analyses.

Although Microsoft Project 2010 has a fair number of cost management features,

many IT project managers use other tools to manage cost information; they do not know

that they can use Project 2010 for cost management or they simply do not track costs

based on a WBS, as most project management software does. As with most software

packages, users need training to use the software effectively and understand the available

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features. Instead of using dedicated project management software for cost management,

some IT project managers use company accounting systems; others use spreadsheet soft-

ware to achieve more flexibility. Project managers who use other software often do so

because these other systems are more generally accepted in their organizations and more

people know how to use them. To improve project cost management, several companies

have developed methods to link data between their project management software and

their main accounting software.

Many organizations are starting to use software to organize and analyze all types of

project data into project portfolios and across the entire enterprise. Enterprise or project

portfolio management tools integrate information from multiple projects to show the pro-

jects’ status and health. See Figure 1-5 in Chapter 1 for a sample. A 2008 study by the

Gantry Group measured the return on investment of implementing portfolio management

software by IT departments. The study estimated savings of 6.5 percent of the average

annual IT budget by the end of year one. The study also found that using project portfolio

management software had the following benefits:

• Improved the annual average project timeliness by 45.2 percent

• Reduced IT management time spent on project status reporting by

43 percent, reclaiming 3.8 hours of each manager’s time per week

• Reduced IT management time spent on IT labor capitalization reporting by

55 percent, recouping 3.6 hours per report

• Decreased the time to achieve financial sign-off for new IT projects by

20.4 percent, or 8.4 days22

As with using any software, however, managers must make sure that the data is accu-

rate and up to date, and ask pertinent questions before making any major decisions.

CASE WRAP-UP

After talking to his colleagues about the meeting, Juan had a better idea about the

importance of project cost management. He understood the value of doing detailed stud-

ies before making major expenditures on new projects, especially after learning about the

high cost of correcting defects late in a project. He also learned the importance of devel-

oping good cost estimates and keeping costs on track. He enjoyed seeing how the cost

estimate was developed for the Surveyor Pro project, and was eager to learn more about

various estimating tools and techniques.

At the meeting, government officials cancelled several projects when the project

managers showed how poorly the projects were performing and admitted that they did

not do much planning and analysis early in the projects. Juan knew that he could not

focus on just the technical aspects of projects if he wanted to move ahead in his career.

He began to wonder whether several projects the city was considering were really worth

the taxpayers’ money. Issues of cost management added a new dimension to Juan’s job.

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Chapter Summary

Project cost management is traditionally a weak area of IT projects. IT project managers must

acknowledge the importance of cost management and take responsibility for understanding

basic cost concepts, cost estimating, budgeting, and cost control.

Project managers must understand several basic principles of cost management to be

effective in managing project costs. Important concepts include profits and profit margins, life

cycle costing, cash flow analysis, sunk costs, and learning curve theory.

Planning cost management involves determining the policies, procedures, and documenta-

tion that will be used for planning, executing, and controlling project cost. The main output of this

process is a cost management plan.

Estimating costs is a very important part of project cost management. There are several types

of cost estimates, including rough order of magnitude (ROM), budgetary, and definitive. Each type of

estimate is done during different stages of the project life cycle, and each has a different level of

accuracy. Several tools and techniques can help you develop cost estimates, including analogous

estimating, bottom-up estimating, parametric estimating, and computerized tools.

Determining the budget involves allocating costs to individual work items over time. It is impor-

tant to understand how particular organizations prepare budgets so estimates are made

accordingly.

Controlling costs includes monitoring cost performance, reviewing changes, and notifying

project stakeholders of changes related to costs. Many basic accounting and finance principles

relate to project cost management. Earned value management is an important method used for

measuring project performance. Earned value management integrates scope, cost, and schedule

information. Project portfolio management allows organizations to collect and control an entire

suite of projects or investments as one set of interrelated activities.

Several software products can assist with project cost management. Project 2010 has many

cost management features, including earned value management. Enterprise project management

software and portfolio management software can help managers evaluate data on multiple projects.