Workpackage 7:17: PiP Evaluation Plan

Background

The PiP workpackage report identifies formal evaluation as an important component of the PiP project (WP7). This document sets out the principal phases of the evaluation to be undertaken under the auspices of the PiP project. The plan is also a requirement of the PiP workpackage report and fulfils workpackage 7, activity 17 (WP7:17).

The purpose of the formal evaluation is to examine core project deliverables, to assess their fitness for purpose and their impact on wider institutional systems and processes. This will involve - among other things - systems testing, the gathering and analysis of user data (from key stakeholders) using a variety of research techniques in order to identify opportunities for system and process enhancements, interpreting the perceptions and reactions of primary and secondary stakeholders, and assessing the overall institutional impact of the project.

Recent PiP documentation lists the current project aims to be the development and testing of a prototype online expert system and a linked set of support materials that could: a) improve the efficiency of course and class approval processes at the University of Strathclyde; b) support the alignment of course and class provision with institutional policies and strategies, and; c) integrate the course and class approval processes into the corporate information environment. An additional objective is to use the findings from prototype testing to share lessons learned and to produce a set of recommendations to the University of Strathclyde and to the HE sector about ways of improving curriculum approval processes. These aims are in themselves insufficiently specific to steer a formal evaluation. The workpackage report therefore documents four distinct evaluative strands (or activities):

1. **WP7:37** Evaluation of system pilot (C-CAP system)
2. **WP7:38** Evaluation of pilot impact and implications for other institutional systems and processes
3. **WP7:39** Evaluation of impact on - and re-engineering of - business processes
4. **WP7:40** Project evaluation

The evaluation plan will broadly follow these workpackage strands as a means of structuring the chronology of the evaluation, with each workpackage strand containing several evaluative phases (see evaluation plan table overleaf). Although the evaluative phases within each workpackage strand are relatively self-contained, it is fully expected that some phases will gather and/or analyse data pertaining to one other phase, either because there is data overlap or because it is expedient to do so. For instance, the evaluation phases associated with strand 37 includes aspects consistent with incremental systems design methodologies [1]; however, questionnaire data will contribute to the findings of strand 38 and vice versa (Figure 1, overleaf). In some circumstances this will allow triangulation to occur thus corroborating evaluative findings from other strands.

The exception to this is WP7:40 (Project evaluation), the output of which is an evaluation report. The evaluation report will collate, analyse and discuss the findings from previous evaluative strands (see Figure 1) and deliver a “critical reflection” of the PiP project. Since this strand will not gather/analyse data and will instead base its intended content on the findings of previous evaluative strands, it is not detailed in this evaluation plan.

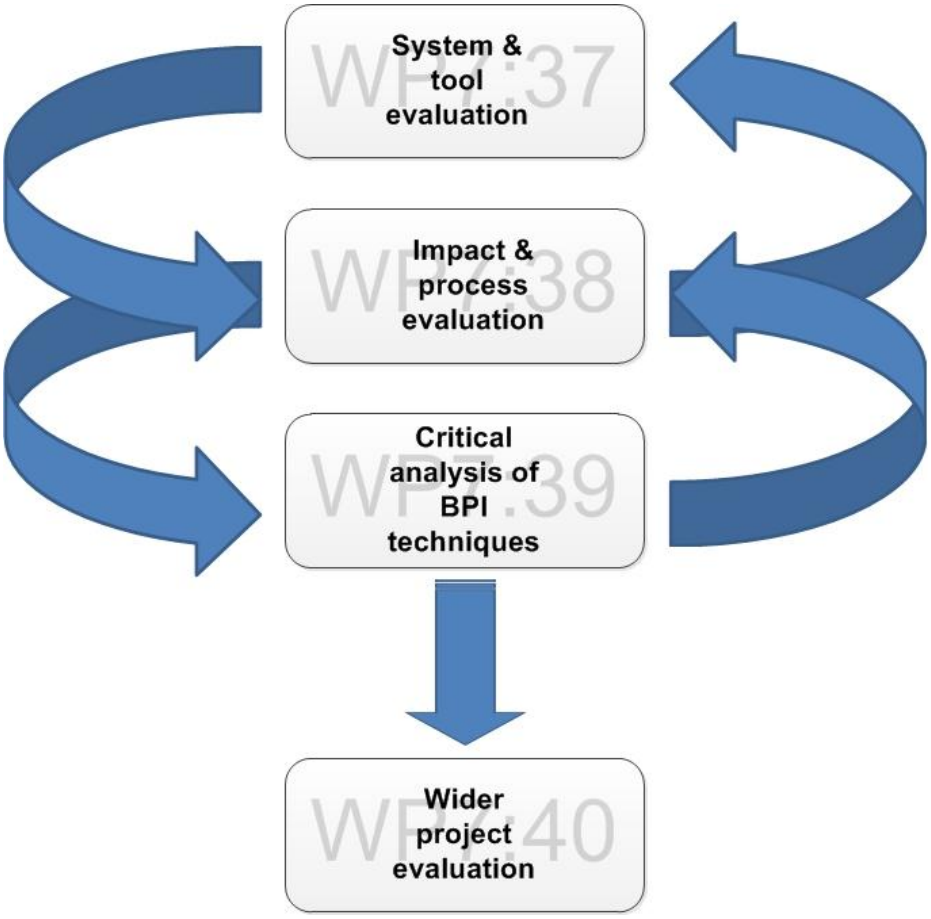

Figure 1: Overview diagram of PiP evaluative strands.

It is anticipated that some aspects of the evaluation will feed into the iterative development process and/or influence the trajectory of stakeholder involvement. For example, aspects of the "heuristic evaluation" phase (Figure 2) will feed into the iterative development of the pilot system, thus enabling sound user testing to occur using a system which has undergone debugging and which addresses key usability concerns. Such a recursive evaluation process is consistent with conventional incremental systems design methodologies (e.g. [1]) and builds upon the informal formative approaches that have been used by the project team to date.

It must be recognised that it will not be feasible to implement all evaluation findings or recommendations within the lifetime of the project, either owing to insufficient project resources or because it lies outside the project's remit; it is nevertheless expected that any such findings will provide a basis for project continuation and sustainability planning.

Previous evaluation plans

An embryonic evaluation proposal was initially included in the original PiP project plan. This, however, has largely been jettisoned owing to JISC approved changes to the PiP project aims / objectives and deliverables, and the recruitment of a dedicated PiP project evaluator. This current plan therefore documents an alternative evaluative approach and is sympathetic to revisions in the project's scope. Details of changes to PiP project aims, objectives and deliverables are available from the PiP Additional Interim Report and Forward Plan March 2011.

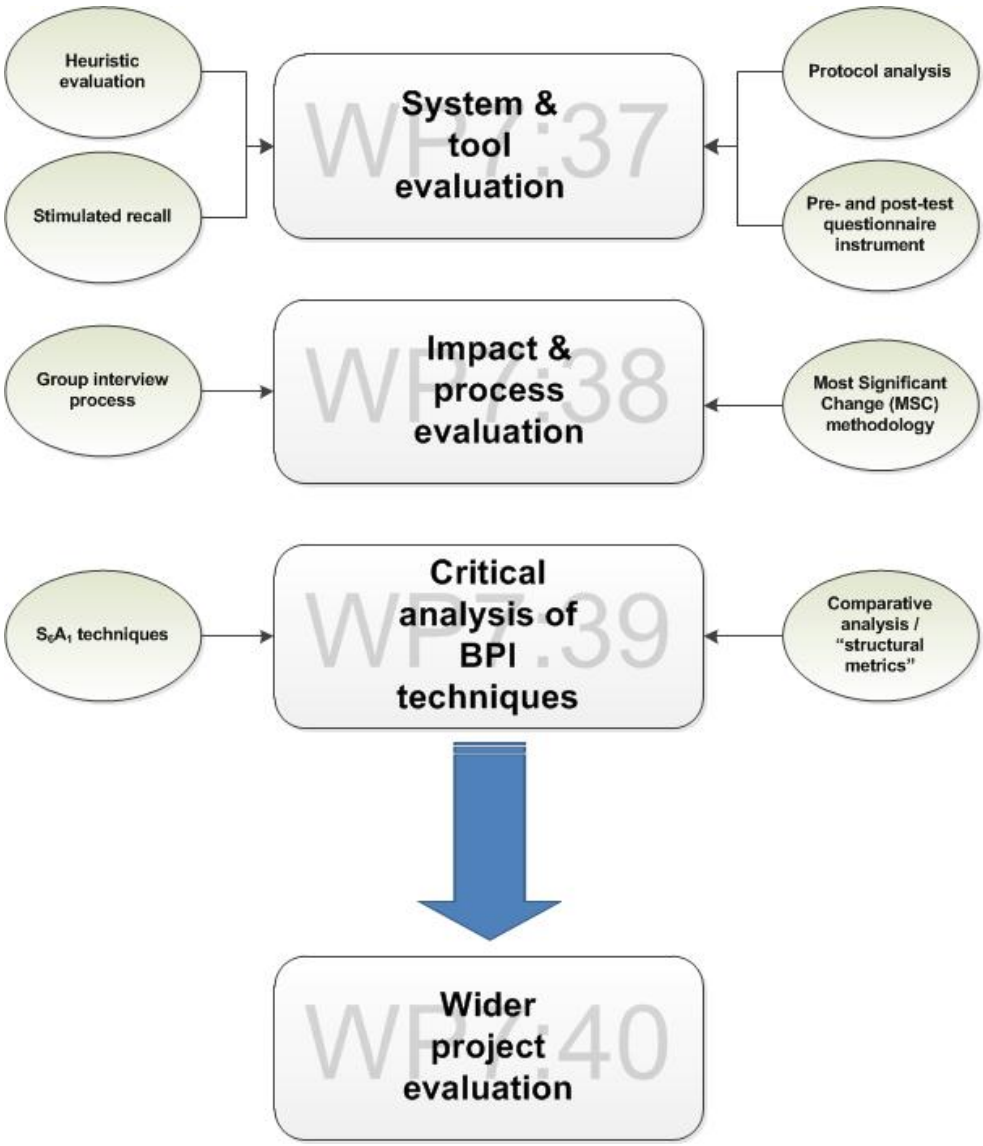

Figure 2: Overview of evaluative strands and evaluative sub-phases.

PiP Evaluation Plan (by evaluative strand)

WP7:37 Evaluation of systems pilot (C-CAP)			
Methodological approach	**Brief description**	**Research questions / evaluative objectives**	**Data / metric**
Phase 1: Heuristic evaluation of C-CAP system **Data collection deadline:** **End November 2012** **Participants: N/A (to be conducted by project evaluator(s)**	Heuristic evaluation is an established method of usability testing and is most commonly deployed in Human-Computer Interaction (HCI) research, e.g. to test user interface designs, technology systems testing, etc. Heuristic evaluation techniques enable a suitably trained evaluator to examine the object of study (e.g. interface or system) and assess its compliance (or lack of) with recognised heuristic evaluation principles, thereby testing its usability. Results of the evaluation are then used to inform system modifications. The approach is favoured in incremental design methodologies as an informal and relatively rapid means of engaging in usability engineering, and is often used as a precursor to user testing, e.g. so that user testing focuses on deeper system issues rather than on those that can easily be debugged. Neilsen and Molich [2] developed nine heuristics which have formed the basis of most subsequent heuristic evaluation approaches. These nine heuristics were later revised and extended [3–5][3] and remain among the most used in usability engineering and testing. These heuristics and their associated methodology will form the basis of this phase of the evaluation, which will use an heuristic evaluation approach to test the PiP C-CAP system. Data from this phase will feed into system improvements prior to phase 2.	Identify usability problems and measure the extent to which the C-CAP system promotes the following heuristic factors: • Visibility of system status; • Match between system and the real world; • User control and freedom; • Consistency and standards; • Error prevention; • Recognition rather than recall; • Flexibility and efficiency of use; • Aesthetic and minimalist design; • Help users recognise, diagnose and recover from errors; • Help and documentation. Note: Owing to the nature of heuristic evaluation, this phase is less driven by pure research questions / evaluation objectives, i.e. it is a low cost and rapid technique in usability engineering used prior to – or instead of - user testing. Results feed into iterative system design processes.	Heuristic factors data matrix; Annotated interface/system walkthroughs.
Phase 2.1: Protocol analysis **Data collection deadline:** **Early February 2012** **Participants: Stakeholder system users – academics (i.e. module/programme designers), faculty managers, academic committees and registry.**	*Protocol analysis* (also known informally as 'think aloud') is a frequently deployed user testing methodology for software, interfaces, systems, etc. in which participants are asked to complete a series of tasks with the test/pilot system while simultaneously verbalising their thoughts. Verbalisations (or protocols) are sound recorded and transcribed for analysis. Additional data may also be gathered, e.g. evaluator logs, screen captures, etc. The methodology is considered to have a high level of face validity as the data captured tends to focus on the *actual use* of a system rather than on user judgements concerning its *perceived* usability or efficacy. Protocol analyses are based on direct participant observation and attempts to model users' real world interaction with a system. As such, evaluators gain an insight into users' cognitive processes as the methodology tends to expose a wide variety of user problems, assumptions or misconceptions, many of which would otherwise go undetected. Protocol analysis was originally formalised by Ericsson and Simon [6] and later Someren et al. [7] and has since become a widely used technique in user testing studies in wide variety of system contexts	This phase of the evaluation is broadly concerned with the practical evaluation of the C-CAP system and aspects of human-computer interaction. It also aims to validate aspects of the heuristic evaluation in phase 1 and evaluate these in a real user context. An exhaustive list of research objectives is therefore unfeasible; however, it is possible to identify the following broad objectives for this phase of the evaluation: • To what extent does the functionality of the C-CAP system meet users' expectations? • To what extent is the C-CAP system usable, its interface instinctive, navigable, etc.? • To what extent can C-CAP support the user in the curriculum design task? How efficient? • To what extent does the context sensitive help assist the user in the curriculum design process? • To what extent can the pilot system maintain	Protocol data for qualitative analysis, to be sound recorded and transcribed for importing to Nvivo of analysis. Protocol data analysis conducted according to established category, coding and verbalisation theory [7]; Recorded screen captures for qualitative analysis (and for stimulated recall in phase 2.2);

	[8–14]. Although the principal source of data for the C-CAP system evaluation will be the protocols (which will undergo qualitative analysis using modified coding strategies, such as segmentation and protocol coding), additional data will be gathered via screen capture and evaluator logs. Where possible results from the protocol analysis will be incorporated into the C-CAP system. Both screen capture and protocols will be used immediately after data collection as the basis for the stimulated recall (phase 2.2). **Note:** *It is anticipated that separate user testing sessions (protocol analysis sessions) will need to be administered for different stakeholder groups.*	user attention and cognitive resources during the curriculum design and approval process?	Evaluator log data.
Phase 2.2: Stimulated recall **Data collection deadline:** **Early February 2012** **Participants: Stakeholder system users – academics (i.e. module/programme designers), faculty managers, academic committees and registry.**	The *stimulated recall* technique (or "retrospective think aloud") is similar to protocol analysis but differs in that data are not collected until after the participant has completed a set user task [10], [15]. A recorded screen capture of the participant's system interactions is played back to the participant who is then asked to articulate their cognitive processes and actions at specific points of the recording. Stimulated recall is generally considered favourable because although the participant is asked to verbalise after they have completed the task, they are often able to provide more detailed verbalisations owing to their reduced cognitive load. Stimulated recall is to be used in conjunction with protocol analysis. A drawback of protocol analysis is that some verbalisations can be inadequate. This is often the case when the user is engaged in cognitively onerous tasks, e.g. when the user is asked to verbalise while using a complex system interface. Since many participants in the PiP evaluation will be engaging in a fictional but nonetheless cognitively onerous process of curriculum design, it is important that a brief stimulated recall phase of evaluation be included. Participants will be asked to engage in stimulated recall *immediately* after protocol analysis data collection in order to review their system behaviour, thus teasing out potentially important data which may have been missed during protocol analysis. Often researchers use one or the other, normally owing to cost considerations; but research studies report on the benefits of both in identifying different HCI issues [16]. It should be noted that PiP's use of stimulated recall will differ from most in that the data collection will occur *immediately* after protocol analysis (thus minimising resource implications) and is likely to be brief.	An important research objective of phase 2.2 is to seek further data on "significant events" within the protocol analysis session, particularly those that were identified in the evaluator log. Significant events can be described as specific parts of the testing session which were problematic or cognitively onerous for the participant. Since stimulated recall is being used to support the protocol analysis, the same general research objectives exist: • To what extent does the functionality of the C-CAP system meet users' expectations? • To what extent is the C-CAP system usable, its interface instinctive, navigable, etc.? • To what extent can C-CAP support the user in the curriculum design task? How efficient? • To what extent does the context sensitive help assist the user in the curriculum design process? • To what extent can the pilot system maintain user attention and cognitive resources during the curriculum design and approval process?	Qualitative data captured from stimulated recall, to be sound recorded and transcribed for importing to Nvivo for qualitative data analysis. Data analysis to be conducted according Holsti's [17] methodologies for content analysis and category creation.
Phase 2.3: Pre- and post-test questionnaire instruments	A pre-test questionnaire will be administered prior to the commencement of phase 2.1 to collect basic demographic information and capture	• Model characteristics of stakeholder users;	Questionnaire data, primarily quantitative

Data collection deadline: **Early February 2012** **Participants: Stakeholder system users – academics (i.e. module/programme designers), faculty managers, academic committees and registry.**	participants' IT efficacy. IT efficacy will be measured using an adapted version of Murphy et al.'s original Computer Self-Efficacy (CSE) scale [18], modified by Torkzadeh et al. [19]. It will also attempt to elicit the opinions of user stakeholders about the efficacy of the current curriculum approval process and its current issues. The post-test questionnaire will be administered after the completion of phase 2.2. The post-test instrument will aim to capture data on users' success with the system and, in particular, gather definitive data on the features that participants found most useful and those they found least useful. This will be based on a customised version of the standard System Usability Scale (SUS) post-test instrument, first reported by Brooke [20] and subsequently developed and deployed by numerous other usability researchers, e.g. [21–23]. Both questionnaire instruments will be administered using Bristol Online Surveys (BOS), an online survey tool.	• Capture data on users' preferred C-CAP features, and their least favourite features; • Elicit data on current approval process and how PiP pilot could contribute to improvements in the process (i.e. its fitness for purpose).	in nature (analysed in MS Excel and SPSS).

WP7:38 Evaluation of pilot impact and implications for other institutional systems and processes			
Methodological approach	**Brief description**	**Research questions / evaluative objectives**	**Data / metrics**
Phase 1: Group interview **Data collection deadline:** **Early April 2012** **Participants: Key and secondary stakeholder groups (likely to include: academics, faculty managers, academic committees and registry).** **<u>IMPORTANT NOTE</u>: Prior to phases 1 and 2 key and primary stakeholders will have engaged in extensive pilot testing of the C-CAP system (circa 2-3 months). Departments for piloting are expected to be identified in January 2012 with piloting beginning in early February 2012.**	Qualitative data capture from key and primary stakeholders will be achieved via stakeholder specific *group interviews*. The weaknesses of such group method data collection techniques are well understood in the research methods literature; however, the use of the group interview approach for this phase of the evaluation is considered appropriate for several reasons: • This phase of the evaluation will seek to triangulate results from the systems testing phase (WP7:37) (as per Figure 1). A mixed method approach is therefore entirely suitable; • The primary focus of this phase is to assess the impact of the PiP C-CAP system and processes within specific stakeholder groups. The organisational nature of this focus necessitates appropriate data collection techniques. Group method approaches are considered one of the most appropriate techniques in such organisational contexts [24]. • Aspects of this phase will feed into WP7:39 (as per Figure1). Stage 6 of Kettinger et al's [25] seminal Stage-Activity (S-A) Business Process Reengineering (BPR) framework notes the use of group methods as an important component for system/process evaluation. Theorists and researchers within the domains of organisational theory and psychology note the importance of the "group method" for exploring and understanding institutional processes [24]. For example, Steyaert and Bouwen [24] introduce a series of data collection techniques based on "natural" and "created" group contexts and delineate selection rules to aid the researcher in deploying the most appropriate technique based on research objectives. Group interviews are most suitable when the phenomenon being studied requires the *exploration* and *description* of ideas. Group interviews are similar to focus groups but differ in their management and focus. In the group interview method the facilitator performs an active role in directing and structuring group discussions. By contrast, focus groups are more conducive to the generation of new ideas or concepts, with the facilitator assuming a passive role.	This evaluation phase is primarily concerned with assessing the impact of the PiP C-CAP system within specific stakeholder groups. Triangulating results from the systems testing phase (e.g. general system issues, corroborating questionnaire data, etc.) is therefore an underlying objective; but more significantly it will seek to understand the potential impact of the C-CAP system among stakeholders and the extent to which the system is considered to support institutional processes. **Note:** The PiP affiliated SLEEK project is also expected to contribute evaluative findings concerning the impact of PiP on other institutional processes.	Qualitative data captured from group interviews, to be sound recorded and transcribed for importing to Nvivo for qualitative data analysis. Data analysis to be conducted according Holsti's [17] methodologies for content analysis and category creation. **Note**: Grounded theory approaches to data analysis [26] are often applied; but recall that the purpose of this evaluative phase is not to generate theory or hypotheses.
Phase 2: Most Significant Change (MSC)	An adapted form of the *Most Significant Change* (MSC) technique will be deployed in phase 2. MSC will be administered at the **same event** as	Phase 2 complements the previous phase (group interviews). MSC has been specifically developed to	MSC story data, to be analysed in

Data collection deadline: **Early March 2012** **Participants: Key and secondary stakeholder groups (likely to include: academics, faculty managers, academic committees and registry).**	phase 1 (i.e. during the same session as the group interview). MSC is a qualitative approach based on stories pertaining to changes that participants have experienced during and/or as a result of a particular project or initiative, rather than "abstract" pre-defined data indicators or metrics [27]. Qualitative research theorists and cognitive scientists have long reported the value of "story collecting" methods to understand complex research phenomena or systems, e.g. organisations and communities [28]. The MSC technique [27] can be classified as a story based method in which the changes participants have experienced in relation to a particular project or initiative are captured. Its popularity is manifest in its ability to capture secondary outcomes, such as those of personal significance to the participants or particular groups of participants [29]. The MSC technique was originally developed as a novel approach to the monitoring and evaluation of complex rural development and international aid programmes [27], [28], [30]. Such projects can be difficult to monitor or evaluate with conventional techniques, owing to their diffuse nature and multifarious outcomes. MSC (and specially adapted versions of the technique) has since found wide deployment within other communities of practice (e.g. [31–34], often as a supplementary evaluation technique. Dart and Davies [27] note the most valuable aspect of MSC to be that data (i.e. stories) are based on "concrete outcomes rather than abstract indicators", thus enabling researchers and relevant stakeholders to make sense of complex project outcomes or changes. Choy and Lidstone [29] summarises some further benefits of MSC: • It offers genuine input from the participants' perspective; • Its participatory nature often yields data on true impact and outcomes; • It frequently draws out details of unexpected changes reflecting distinct individual and/or organisational values; • It is not threatening to participants, e.g. "does not have a right or wrong answer and recognises two sets of opposing outcomes: expected/unexpected; and agreed/disputed meanings" (Ibid.); • It "de-formalises" evaluation. Participants are encouraged to express what is most valuable to them and/or most important within their socio-cultural contexts, and; • Participants are best qualified to comment on (or share stories) the most significant changes within their context. They are the "cultural insiders" with knowledge and understanding about the dynamic and multifaceted contexts of their environment(s).	better understand the potential impact of complex projects (such as PiP), uncovering data on the true impact, outcomes and changes of projects. A benefit of MSC is its ability to draws out details of unexpected changes and, for this reason, not all research objectives can be identified at this stage; nevertheless, the following impact / change orientated objectives can be identified for this phase: • Extent to which PiP has affected change within institutional processes; • Capture and evidence the nature of change, efficiencies, outcomes, etc.; • Nature of identified changes across stakeholder groups (e.g. patterns, discords, synergies, etc.); • Which aspects of PiP have the greatest potential for institutional change	accordance with Davies and Dart's [30] verification, quantification, secondary analysis and meta-monitoring approaches.

	WP7:37 and 39 will uncover numerous “abstract indicators” which will be useful to inform the evaluation. The use of MSC for 38 is therefore an appropriate complementary technique to ensure “concrete outcomes” are identified, thereby better informing the evaluation report.		

WP7:39 Evaluation of impact on - and re-engineering of - business processes			
Methodological approach	**Brief description**	**Research questions / evaluative objectives**	**Data / metrics**
Phase I: Business process analysis **Data collection deadline:** **End March 2012 (although data collection for this phase can begin at any point of the evaluation process)** **Participants: No participants are required for this phase of the evaluation. Data collected from WP7:38 will be used for Stage-Activity Framework analysis.**	This phase entails an analysis of the business process improvement (BPI) process, as conducted by the PiP project. It is interested in understanding the efficacy of BPI as a technique within the PiP project and its potential within the HE sector more generally. The evidence base for this phase of the evaluation is problematic. A baselining report was delivered to JISC in September 2009 ("Baseline of process and curriculum design activities") [35]. This provides a useful schematic and a basis for comparative analysis; however, few performance indicators were recorded or collected at this time, either because such data did not exist or was difficult to acquire. This evaluative phase therefore has few objective metrics to use in its analysis. Evaluation of the BPI process within PiP will therefore require data from a number of disparate sources and the increased use of theoretical and qualitative approaches in order to assess process impact. This will include the following: • Aspects of Kettinger et al.'s [25] Stage-Activity Framework will be deployed. Stage 6 "Evaluate" (S_6A_1) documents a suite of technique to be used in BPI evaluation. 1. *Group interview (focus group)* 2. *Employee and team attitude* 3. *Pareto analysis (metrics permitting)* Sarkis and Talluri [36] note the need for qualitative data to feature prominently in any evaluation of BPI or process reengineering. Recall that data from WP7:38 will feed into the evaluative activities of WP7:39. No qualitative data will be collected in this phase. Data to fulfil group interviews (1) and employee attitude (2) of S_6A_1 will be collected during WP7:38. Improvements and significant changes to institutional process are likely to be identified in WP7:38. • Comparative analysis of BPI using baselining model and current model. Models will be subject to theoretical analysis using the qualitative benchmarking technique [37] and, where possible, Balasubramanian and Gupta's [38] "structural metrics" will be used. Balasubramanian and Gupta's list of structural metrics can be easily deployed to create a formal approach to BPI evaluation and many of their metrics are applicable to the HE sector, such as Branching Automation Factor (BAF), Communication Automation Factor (CAF), Activity Automation Factor (AAF), etc.	A broad evaluative objective is to capture and evidence improvements in the curriculum design and approval process made by the PiP project. Specific research questions include: • To what extent have improvements to the curriculum design and approval process resulted in institutional efficiencies, i.e. has the process been improved significantly? This single research question forms the largest focus of this evaluative phase. Additional questions include: • Can additional improvements be identified and process enhancements made? • To what extent are such approaches to BPI applicable in university processes? • To what extent has it promoted alignment with institutional priorities?	Qualitative data captured from group interviews (WP7:38), to be sound recorded and transcribed for importing to Nvivo for qualitative data analysis. Data analysis to be conducted according Holsti's [17] methodologies for content analysis and category creation and to be used for S_6A_1 of Kettinger et al.'s [25] Framework. Data to fulfil group interviews (1) and employee attitude (2) of S_6A_1. Fishbone analysis (and Pareto analysis, metrics permitting) to enable theoretical evaluation of BPI. Baselining model and current model. Models subject to comparative theoretical analysis; Balasubramanian and Gupta's [38] "structural metrics" to be used to measure business process efficacy. **Tentative data source:** SLEEK benchmarking data?

	Note: In conjunction with the Department for Design, Manufacture and Engineering Management at the University of Strathclyde, SLEEK/PiP has initiated a further curriculum design benchmarking exercise. It is therefore anticipated that additional data will emerge in the latter phases of the evaluation which can be used to validate previous baselining work, thus simplifying this evaluative phase.		

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